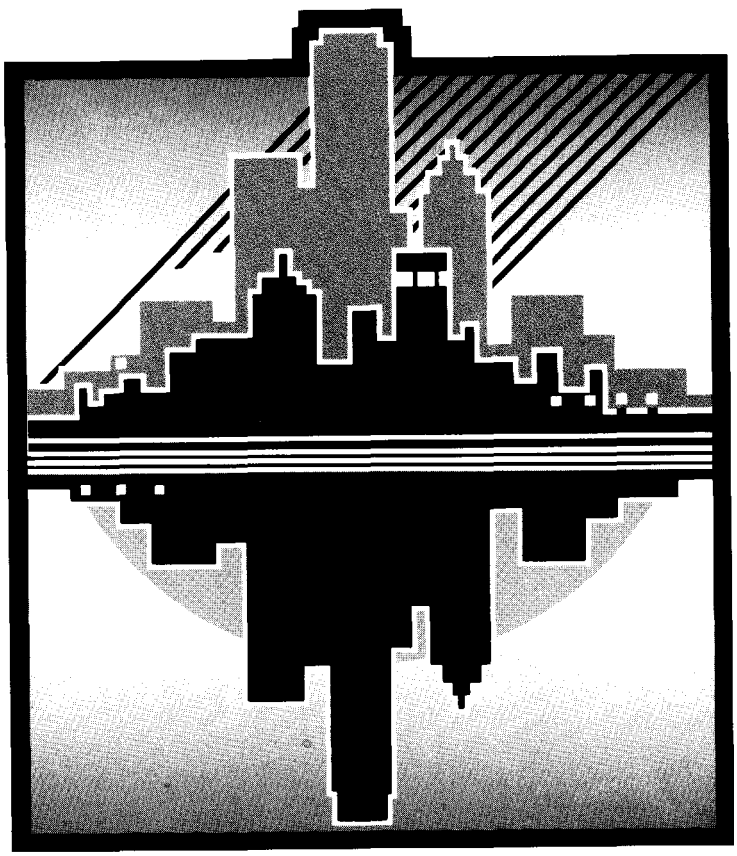
University Transportation Research Center

REGION II



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GOODS MOVEMENT CHARACTERISTICS IN THE NEW YORK CITY REGION

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ADDENDUM
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Prepared for

Public Planning & Policy Studies, Inc.
And the
Japanese Ministry of Construction

PREFACE

This report is an overview of goods movement characteristics in the New York City Metropolitan Region. It is based upon information gathered from personal interviews and available published sources. This report has been conducted for the Japanese Ministry of Construction upon request by Public Planning & Policy Studies Inc.

GOODS MOVEMENT CHARACTERISTICS IN THE NEW YORK CITY REGION

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TABLES (con't)

GOODS MOVEMENT CHARACTERISTICS

IN THE

NEW YORK CITY REGION

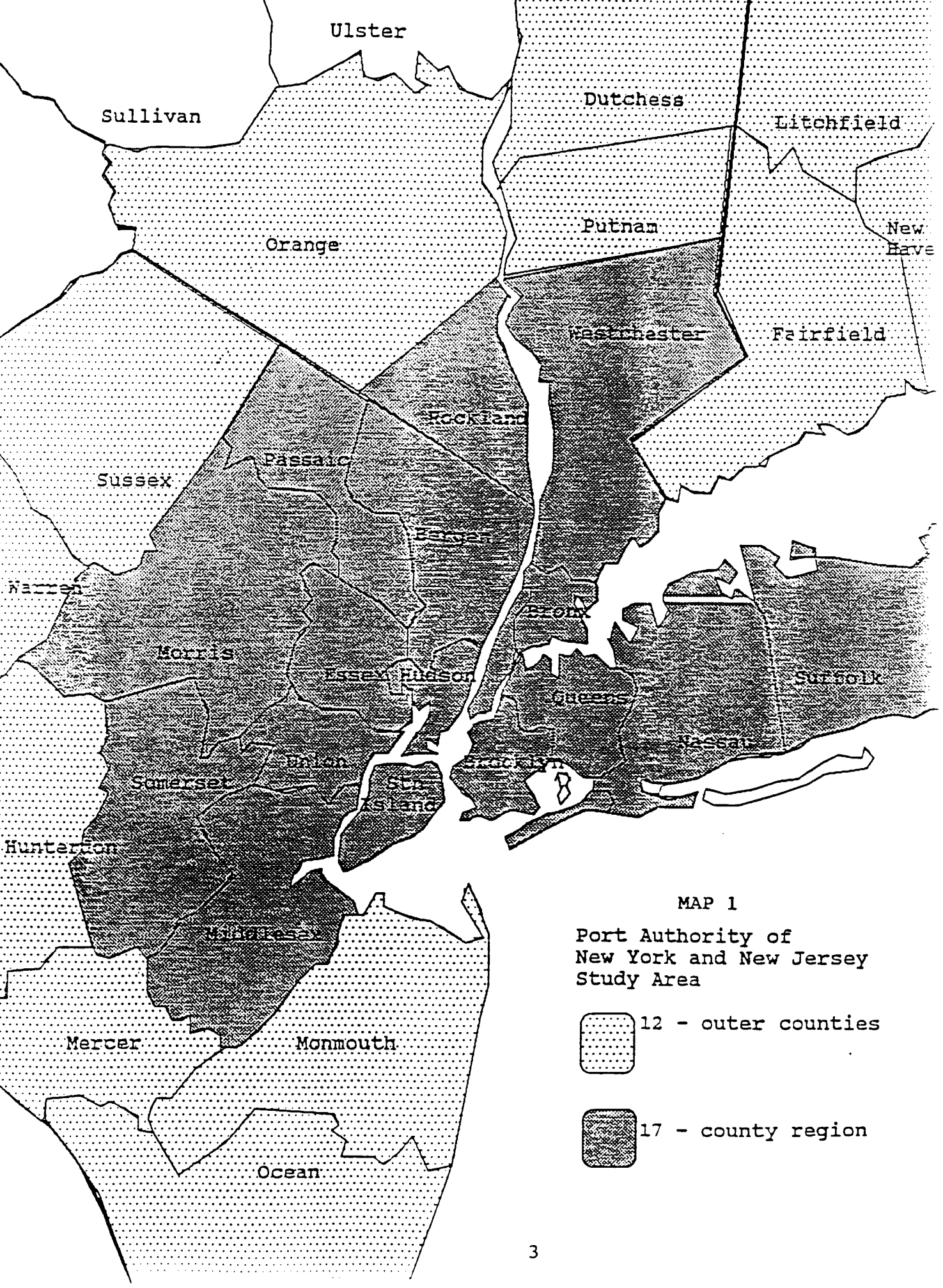
ABOUT THE STUDY

More than 700 million tons of goods are moved in and out of the New York Metropolitan Region each year. Nearly 20 million residents of northern New Jersey, southern New York and southwestern Connecticut depend on the Region's goods movement system for supplies. The efficient transport of goods is vital to this Region's economic stability and competitiveness. The following study overviews the Region's complicated system of goods movement and provides various in depth information regarding the systems's characteristics. Goods transported by air, truck, rail and water are tracked.

This study is limited by the amount and quality of data available on the subject. In some cases data is not yet published. In other cases, information simply does not exist. For instance, truck vehicle miles traveled (VMTs) have never been calculated. Vans, which are an essential component of the Region's goods movement system, are almost always excluded from any analysis. Environmental impacts of goods movement - noise, infrastructure wear and air quality - are not measured, although truck emission inventories will soon be available. Even in cases where data does exist, it is infrequent, inconsistent and incomparable.

Inconsistency in data originates from the separate yet overlapping jurisdictions of organizations interested in charting regional goods movement. Each organization defines their area differently. The Port Authority of NY & NJ (PA), an authority responsible for a variety of tasks including the operation of the Region's three airports and six interstate vehicular Hudson River Crossings, studies primarily a 17 county area. At times, their study area is expanded to 29 counties (See Map 1). The New York Metropolitan Transportation Council (NYMTC), the Metropolitan Planning Organization (MPO) for the downstate NY area, is responsible for overseeing transportation plans of a 10 county region. When NYMTC conducts more comprehensive studies, information from a 21 county tri-state region is collected (See Map 2). The Regional Plan Association (RPA), a 70 year old non-profit organization interested in promoting the well-being of the Region, studies a 31 county area (See Map 3).

Varying definitions from regional organizations coupled with more conflicting definitions from various local organizations, contribute to the difficulties of analyzing the Region's goods movement characteristics. However, prompted by the enactment of two federal laws, a trend towards synthesizing goods movement information has recently emerged. These laws, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clean Air Act Amendments of 1990 (CAAA), mandate a system wide approach to transportation improvements and investments. Currently, there are many projects in the works addressing the issue of data compatibility.

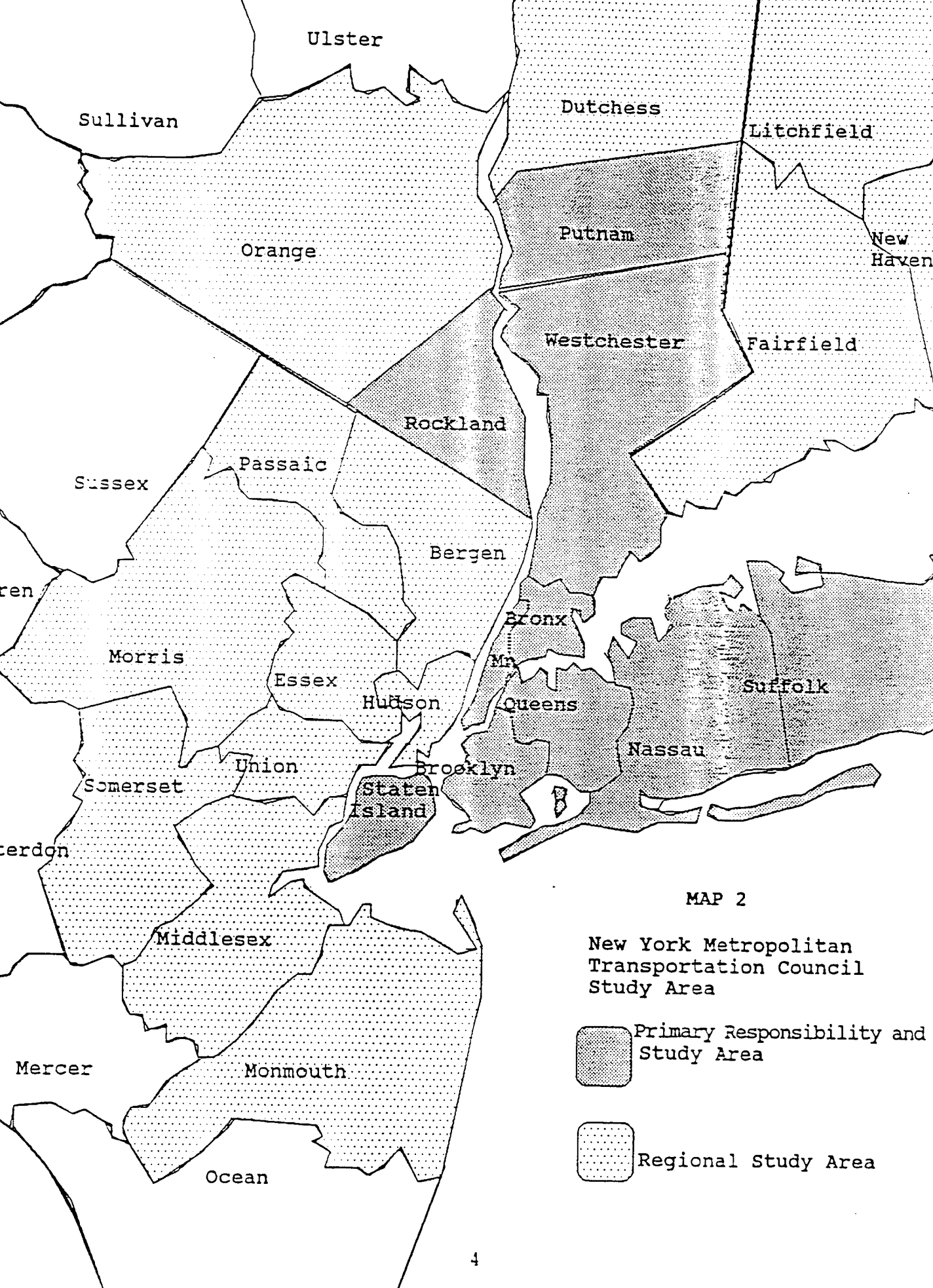


MAP 1

Port Authority of
New York and New Jersey
Study Area

12 - outer counties

17 - county region

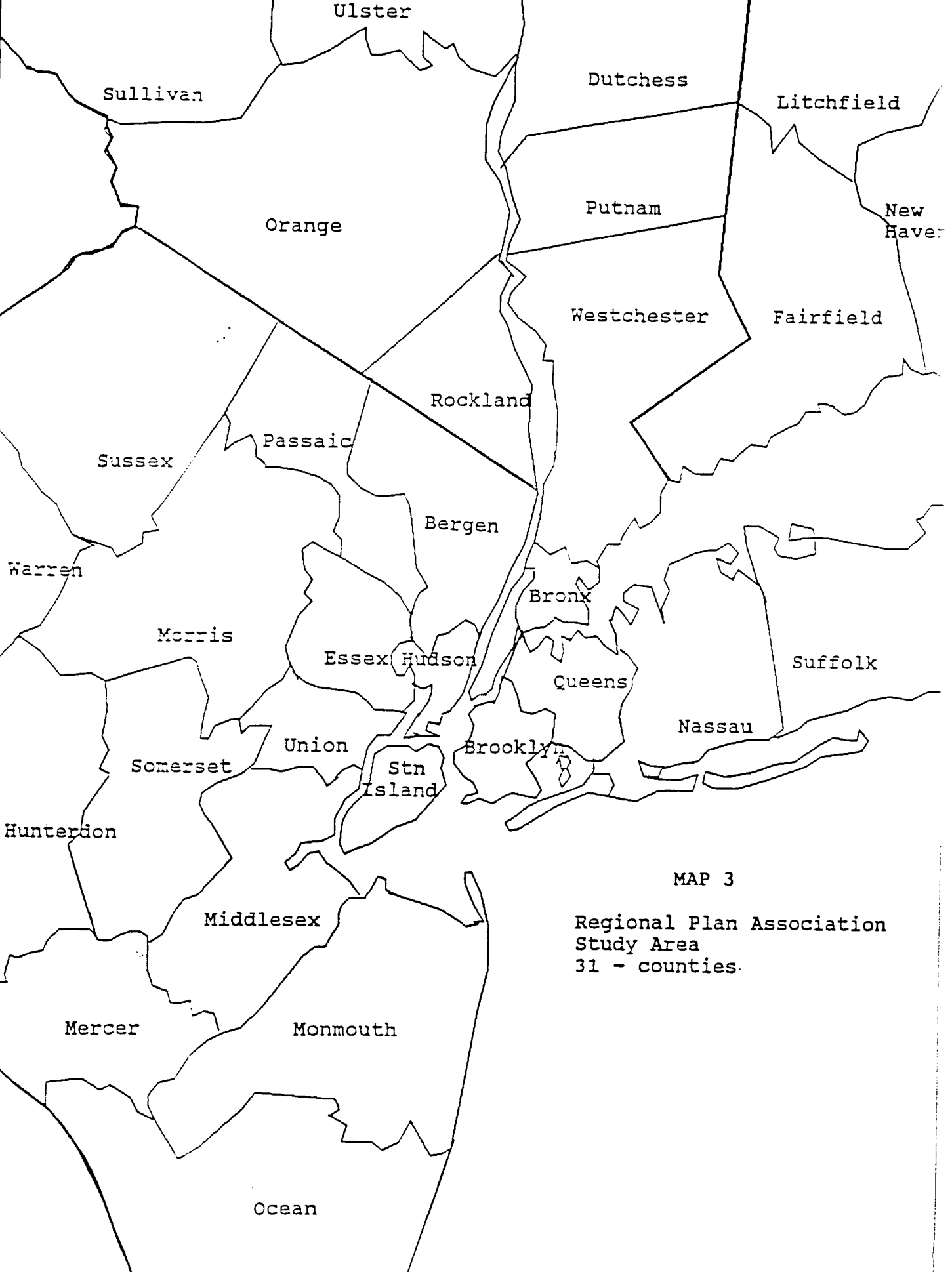


MAP 2

New York Metropolitan Transportation Council Study Area

Primary Responsibility and Study Area

Regional Study Area



MAP 3

Regional Plan Association
Study Area
31 - counties

REGIONAL GOODS MOVEMENT

The NYC Region has historically been a center for national and international trade. Strategically located on the Atlantic Ocean at the mouth of the navigable Hudson River, the Region sits in the middle of the megalopolis stretching across most of the East Coast, from Portsmouth, New Hampshire to Portsmouth, Virginia. Consequently, it is within hours reach of the country's largest markets. With the opening of the Erie Canal in 1825 making NY conveniently accessible to the rest of the nation, the Region became one of the busiest trading centers in the world and attracted an abundant number of diverse businesses to its center.

Today, the Region is home to 19.8 million residents, 600,000 business establishments and 8.8 million employees. The Region is one of the largest and densest in the world. In NYC, there are 17,600 persons per square mile or 6,800 per square kilometer (See Tables 1, 2 and Maps 4, 5). Two-thirds of the Region's population and jobs lie on the east side of the Hudson River; 1.5 million in population, 43,000 per square mile, 2.6 million jobs and 100,000 establishments in Manhattan alone. Moving people and goods efficiently to, from and within the Region is no simple task.

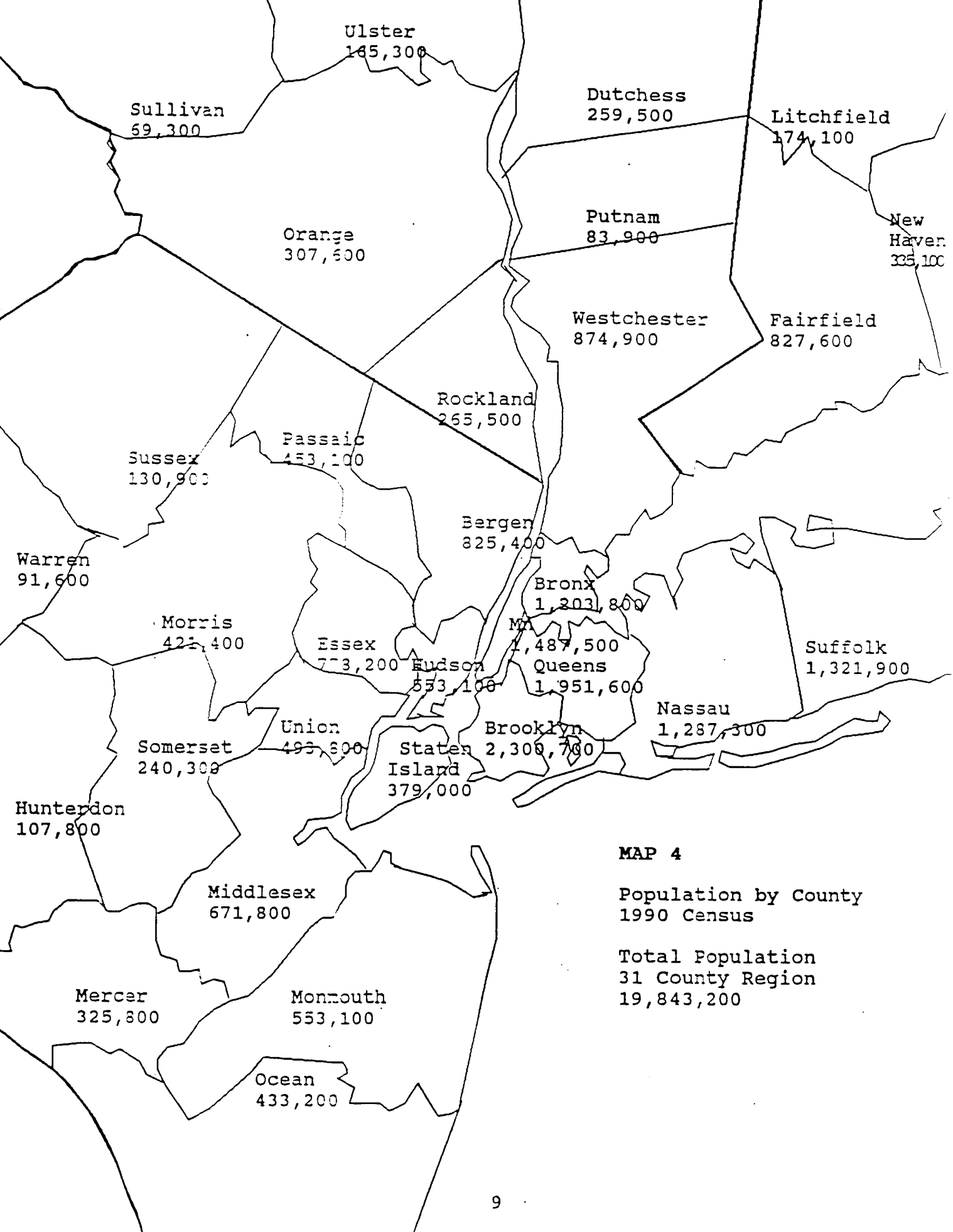
Whether the good is a raw material or a finished product, its cost is a direct function of its delivery process. The faster a good arrives and the more reliable its schedule, the less it costs. Increased productivity means lower costs to producers and consumers. With the dependence on just-in-time delivery and heightened national and international competitiveness, consistent efficient goods movement is absolutely necessary for all regions.

Table 1
Population Densities
in New York City

County	Population Density (Sq. Mi.)	Population Density (Sq. Km.)	Total Population	Total Area (Sq. Mi.)	Total Area (Sq. Km.)
Bronx	20,900	8,080	1,203,800	57.5	149.0
Kings (Brooklyn)	24,000	9,220	2,300,700	96.3	249.5
New York (Manhattan)	43,000	16,660	1,487,500	34.5	89.3
Queens	14,000	5,520	1,951,600	136.5	353.8
Richmond (Staten Island	4,200	1,620	379,000	90.5	234.3
Totals	17,600	6,800	7,322,600	415.4	1076.4

Table 2
Population and Employment
by County

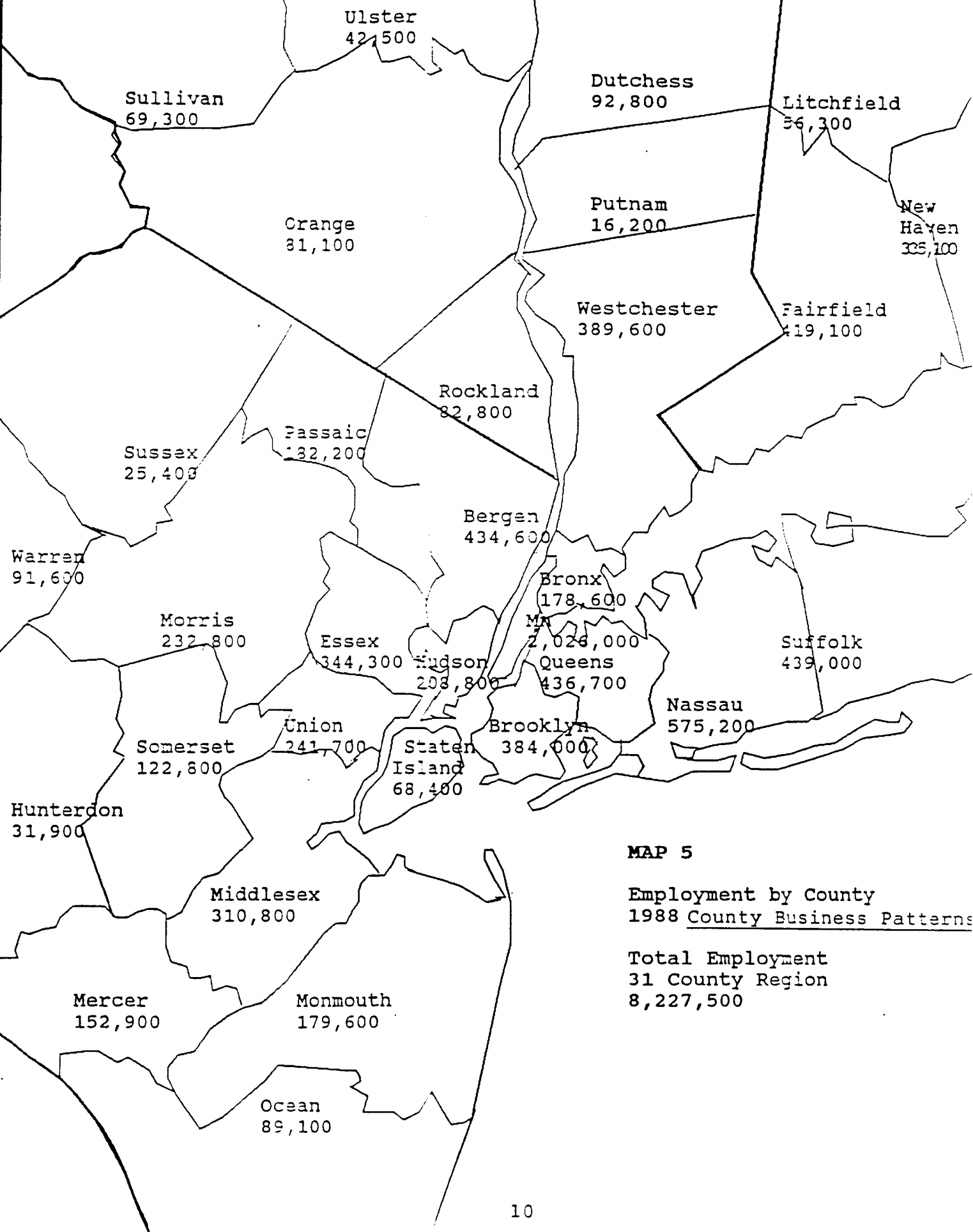
County	Population	Employment
Bergen	825,400	434,600
Bronx	1,203,800	178,600
Brooklyn	2,300,700	384,000
Dutchess	259,500	92,800
Essex	778,200	344,300
Fairfield	827,600	419,100
Hudson	553,100	208,800
Hunterdon	107,800	31,900
Litchfield	174,100	56,300
Manhattan	1,487,500	2,026,000
Mercer	325,800	152,900
Middlesex	671,800	310,800
Monmouth	553,100	179,600
Morris	421,400	232,800
Nassau	1,287,300	575,200
New Haven	804,200	335,100
Ocean	433,200	89,100
Orange	307,600	81,100
Passaic	453,100	182,200
Putnam	83,900	16,200
Queens	1,951,600	436,700
Rockland	265,500	82,800
Somerset	240,300	122,800
Staten Island	379,000	68,400
Suffolk	1,321,900	439,000
Sullivan	69,300	18,200
Sussex	130,900	25,400
Ulster	165,300	42,500
Union	493,800	241,700
Warren	91,600	29,000
Westchester	874,900	389,600
Total	19,834,200	8,227,500



MAP 4

Population by County
1990 Census

Total Population
31 County Region
19,843,200



MAP 5

Employment by County
1988 County Business Patterns

Total Employment
31 County Region
8,227,500

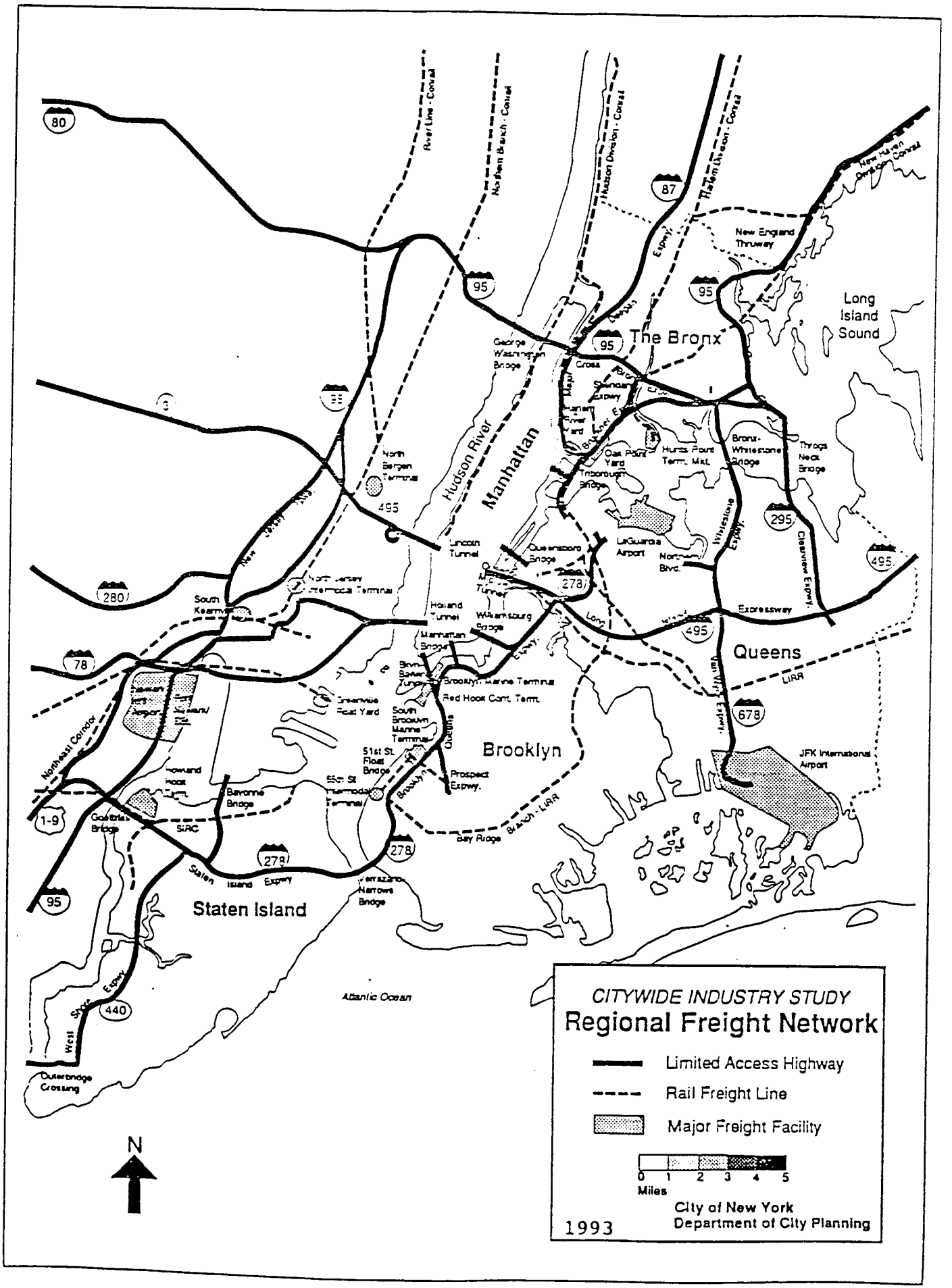
The PA estimates that in 1990, 726 million tons of freight were moved to, through or out of the Region. Most of the Region's goods arrive on the west side of the Hudson, in New Jersey (NJ). NJ offers large amounts of available land at low costs necessary for the storage and modal transfer of goods. The New Jersey Transportation Coordinating Council (NJTCC) claims that NJ contains the greatest concentration of trucking industries and the largest containerized cargo facilities in the United States.

Facilities in NJ function as the "break-bulk" point. Here goods arriving by rail, water and long-distance motor carrier are sorted and then delivered to their final destination almost always by truck. Since 2/3rds of the population and jobs are east of the Hudson, the majority of the goods necessary to sustain the Region's residents and businesses must travel across the Hudson River. This intermodal nature of the Region's goods movement system requires large terminals, ports, rail lines, highways, airports, warehouse and transfer stations (See Map 6).

The Region currently relies heavily on trucks to move its goods. Advances in technology, construction of the Holland and Lincoln Tunnels, development of the Interstate Highway System, old urban infrastructure standards and new business location determinants - ie: near highway interchanges, has led to declines in the use of water and rail for goods movement. Today, over 90% of the Region's goods travel at least part of the way by truck. Table 3 shows the amount and percentage of regional goods movement by mode.

The process of transporting goods to the Hunts Point Terminal Market accurately reflects the Region's goods movement system. Hunts Point Market, NYC's and Long Island's principal

MAP 6


80
River Line - Canal
Northern Branch - Canal
Hudson Division - Canal
Harlem Division - Canal
New Haven Division - Canal
87
New England Thruway
95
The Bronx
Long Island Sound
George Washington Bridge
Major Deegan Expressway
Triborough Bridge
Oak Point Yard
Hunts Point Term. Mkt.
Bronx-Whitestone Bridge
Throgs Neck Bridge
Hudson River
Manhattan
North Bergen Terminal
495
New Jersey
Lincoln Tunnel
Queensboro Bridge
LaGuardia Airport
Northern Blvd.
Whitestone Expressway
295
Clearview Expwy.
280
North Jersey Intermodal Terminal
South Kearny
Holland Tunnel
Williamsburg Bridge
Manhattan Bridge
Long Island Expressway
Queens
78
Brooklyn Marine Terminal
Red Hook Cont. Term.
Greenville Port Yard
South Brooklyn Marine Terminal
Northeast Corridor
Howland Hook Term.
51st St. Float Bridge
65th St. Intermodal Terminal
Gowanus
Brooklyn
Prospect Expwy.
Verrazano Narrows Bridge
Staten Island Expwy.
Staten Island
Atlantic Ocean
Bay Ridge Branch - LIRR
LIRR
678
JFK International Airport
Van Wyck Expwy.
1-9
Goethals Bridge
SIRC
Bayonne Bridge
440
West Shore Expwy.
Outerbridge Crossing
N
CITYWIDE INDUSTRY STUDY
Regional Freight Network
Limited Access Highway
Rail Freight Line
Major Freight Facility
0 1 2 3 4 5
Miles
City of New York
Department of City Planning
1993

food distribution center, is currently the country's largest. Located in the southeast corner of the Bronx, Hunts Point employs 100,000 workers on 329 acres. One major route to Hunts Point is the following: Commodities arrive by rail to Conrail's South Kearny, NJ rail yards. Goods are then transferred to trucks and driven to the Bronx. Usually, these vehicles return empty. Consequently, 30,000 truck trips are made per year or 80 trips per day across the Hudson via the George Washington Bridge (RPA 1992).

TABLE 3
REGIONAL MODE ACTIVITY

MODE	% of Total	Millions of Tons of Goods
Truck	95.35	692.2
Rail	2.75	20.0
Water	1.65	12.0 (long tons)
Air	0.25	1.8

Source: Regional Plan Association, March 1992; Port Authority of NY & NJ, 1991.

TRUCKS

As mentioned, trucks are the primary mode used for transporting goods throughout the Region. About 95% of the Region's goods are moved by truck, almost double the national percent of 42 (RPA 1992). Generally, larger heavy duty trucks with 5 or more axles are used to move goods around the Central Business District (CBD) in Manhattan - 60th Street and below, while smaller light duty delivery trucks with 2 or 3 axles are used to move goods to and from the CBD. During midday in the CBD, the NYC DOT estimates that 65% of all vehicles are commercial and 37% moving goods. RPA has estimated that a total of 85,000 truck movements are made in and out of the CBD every day. With 1,525,000 vehicles per day moving in and out of the

CBD, trucks represent 6% of the total. If delivery vans were included in the analysis, the amount of vehicles moving freight in the CBD would almost double according to a small sample conducted by the PA (Millendorf 1989). Vans continue to be the choice of many industry companies because of their ability to navigate city streets and to meet limiting city regulations.

The total number of trucks entering NYC has steadily increased over the years, but has decreased as a percent of total vehicles. From 1974 to 1986 the percent of total vehicles traveling eastbound across PA facilities increased by 39%. Trucks increased by less than half that number, 18%, resulting in a decrease of trucks as a percent of total vehicles (See Table 4). This occurrence is due mainly to escalation in ownership and use of automobiles, especially single occupancy vehicles (SOVs). Trucks must share their network with SOVs and are often prohibited from certain roads (See Map 7). Without supplying additional capacity, total Regional VMTs amounted to 295.8 million per day in 1990 up by 8% from 1987 when daily VMTs totaled 273.4 million (NYMTC 1993). The trend of rapid VMT increases, usually leading to congestion, is not limited to this Region. 65% of the nation's urban freeways are congested during rush hours. There are approximately 1.5 million trucks registered in the Region as compared with 9.8 million automobiles registered in the Region.

Volumes, Origins/Destinations & Commodities

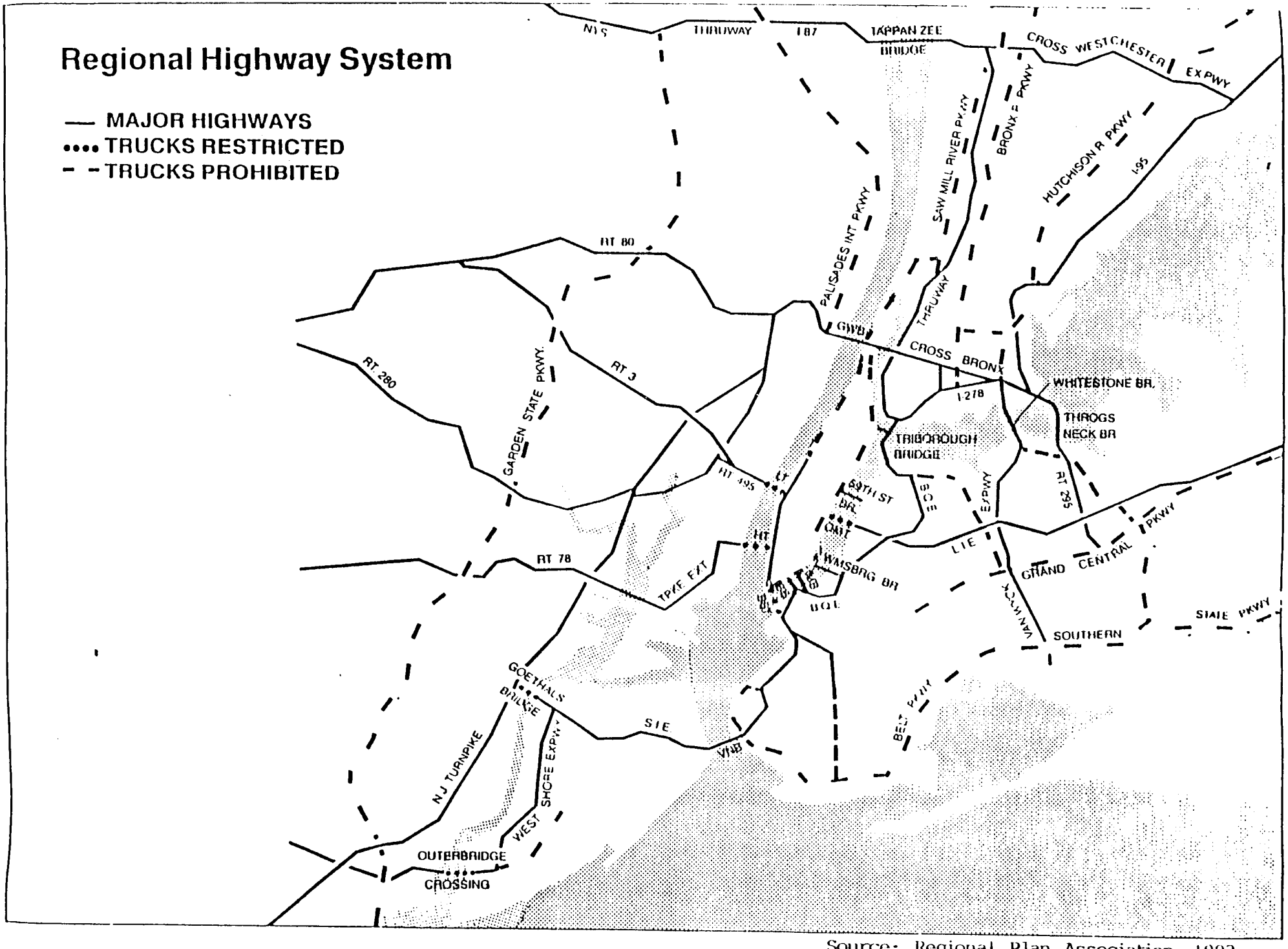
The movement of goods by trucks is monitored primarily by counts and surveys as trucks cross into Manhattan and other NYC areas. Agencies responsible for the crossings conduct studies. The PA, responsible for Hudson River crossings (See Map 8), reports that 30,000 trucks or 7%

Table 4
Annual Eastbound Truck Traffic
at the Six Port Authority Crossings
1974-1986
(in thousands)

Year	Vehicles	Trucks	Trucks % of Total Vehicles	Small Trucks	Large Trucks
1974	79,221	6,654	8.4%	3,270	3,384
1975	80,642	5,782	7.2%	2,892	2,890
1976	81,431	6,315	7.8%	3,087	3,228
1977	82,778	6,452	7.8%	3,091	3,361
1978	83,646	6,626	7.9%	3,097	3,529
1979	84,457	6,816	8.1%	3,164	3,652
1980	87,957	6,660	7.6%	3,089	3,571
1981	91,259	6,631	7.3%	3,075	3,556
1982	93,807	6,534	7.0%	3,038	3,496
1983	97,670	6,827	7.0%	3,204	3,623
1984	100,953	7,346	7.3%	3,420	3,926
1985	105,698	7,561	7.2%	3,552	4,009
1986	110,112	7,851	7.1%	3,647	4,204
1974 -1986 %Change	39.0 %	18.0 %	- 15.5 %	11.5 %	24.2 %

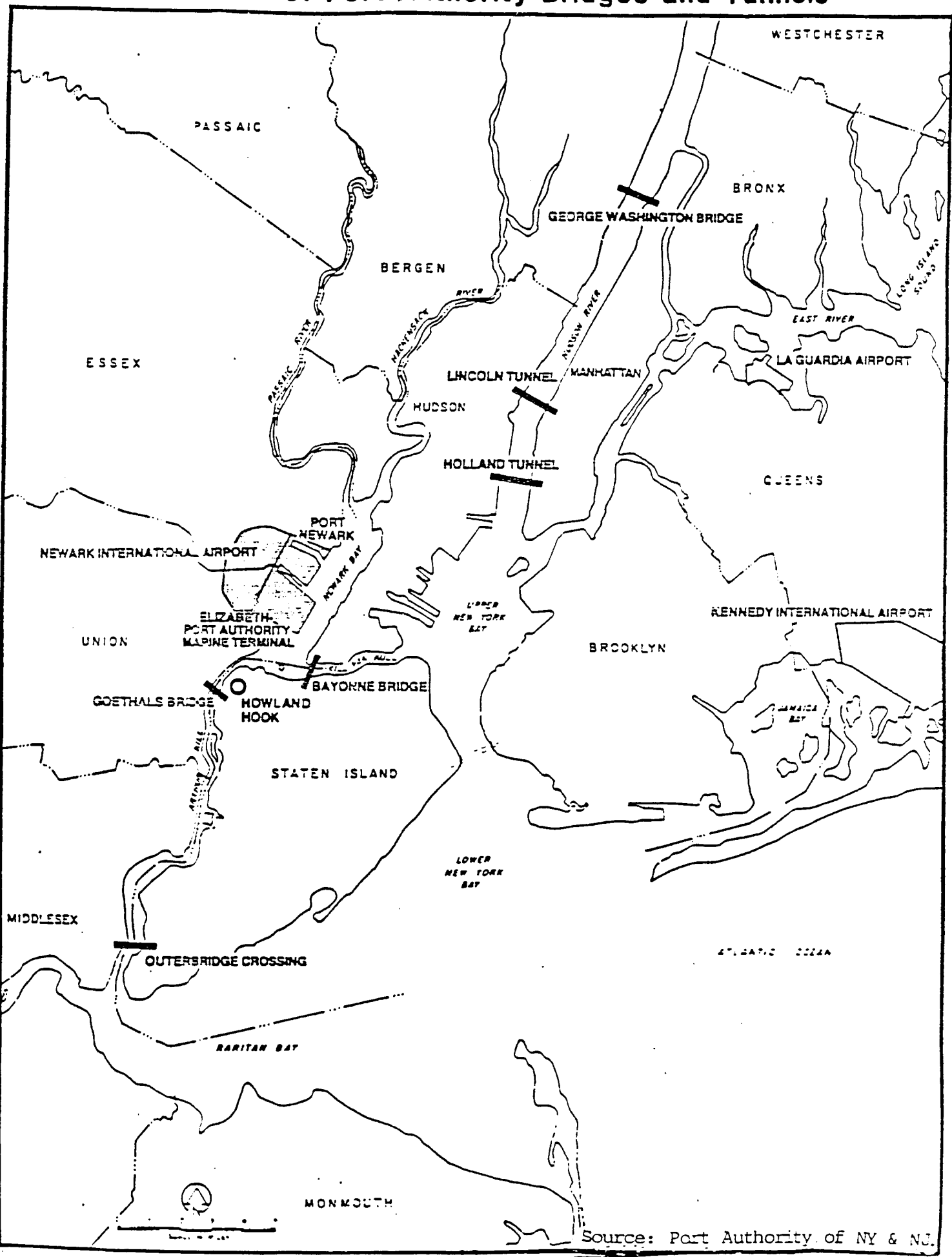
Source: Port Authority of New York & New Jersey

MAP 7



Source: Regional Plan Association, 1992.

Location of Port Authority Bridges and Tunnels



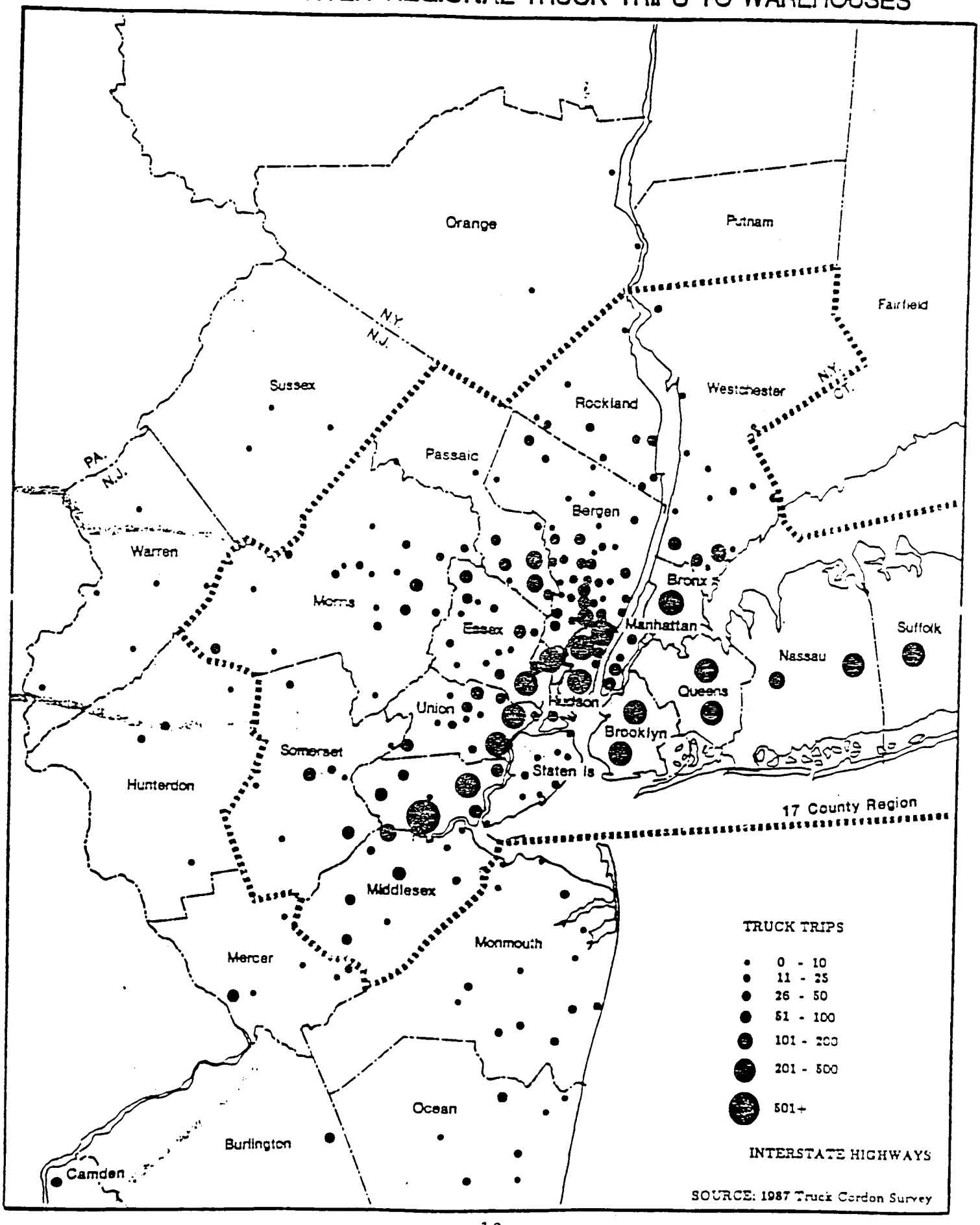
Source: Port Authority of NY & NJ.

of all vehicles travel eastbound daily. 9,000 trucks travel eastbound during the morning peak 6 - 10 am. 50,000 trucks use the facilities per day. Half of these trucks use the George Washington Bridge which has more lane capacity than other Hudson River Crossings (See Table 12). 80% of trucks using the Holland and Lincoln Tunnels leading to the CBD are small and medium duty delivery trucks with 2 or 3 axles. 35% using the GWB are this type. The majority of trucks using the GWB are large vehicles. 2/3rds of trucks using PA facilities have origins and destinations in the Region (See Table 5). The majority of trips, 22.7%, originate from nearby Hudson County, NJ. 21.7% of the trucks using the GWB are destined for Long Island. 61.5% of trucks using the Tunnels are destined for Manhattan. 36.7% using the Staten Island Bridges are destined for Brooklyn (More detailed origin/destinations survey results of PA facilities appear in the Appendix).

Table 6 categorizes what types of structures trucks are traveling to and from, such as warehouses (WRHS), factories (FAC), truck terminals (TT) and piers (PR). The table suggest that 20% of trucks using PA facilities have origins and destinations of warehouses. Map 9 shows general locations of regional warehouse trips.

Frequencies of truck trips using PA facilities are shown in Table 7. The greatest number of trips are made daily, over 40%. In a separate and more specific survey conducted for NYS DOT of truck trips made one-way inbound on the Gowanus Expressway, a segment of severe congestion, the majority of trips were made 6 to 10 times per week, 38.2%. 37.9% of those surveyed made the trip 1 to 5 times per week and 24.1% made the trip 11 or more times per week. Furthering congestion, 70% of all inbound trips occurred during the 7 - 9 am morning

AVERAGE DAILY INTER-REGIONAL TRUCK TRIPS TO WAREHOUSES



rush hour (DeLeuw, Cather 1992). Even though trucks account for a small percent of total vehicles, the number of trips trucks make is significant.

TABLE 5
ORIGINS AND DESTINATIONS
EASTBOUND PORT AUTHORITY CROSSINGS

ORIGINS	Overall	GWB	SIB	Tunnels
Middlesex	9.1	7.7	17.9	4.5
Passaic	5.6	7.8	1.5	5.5
Union	10.3	8.0	18.9	7.8
Essex	11.0	10.6	8.6	13.1
Hudson	22.7	13.7	12.4	44.2
Bergen	11.2	13.7	3.4	13.5
Other NJ	7.2	9.8	12.2	5.8
Other	22.9	28.6	25.2	5.7

DESTINATIONS	Overall	GWB	SIB	Tunnels
Connecticut	7.1	15.2	-	-
Westchester	5.6	11.9	0.3	0.3
Bronx	7.3	15.1	0.2	0.7
Queens	13.3	13.5	13.0	13.0
Manhattan	21.3	4.6	2.4	61.5
Brooklyn	15.9	3.1	36.7	19.5
Staten Island	8.0	-	33.8	-
Long Island	13.9	21.7	10.2	4.7
Other New Eng	6.3	13.4	0.3	0.3
Other	1.4	1.5	3.1	-

Source: Truck Commodity Survey, 1987.

Note: GWB = George Washington Bridge, SIB = Staten Island Bridges-Outerbridge Cross., Goethals Br., Bayonne Br., Tunnels = Holland & Lincoln Tunnels.

TABLE 6
O/D PAIRS BY PERCENT
PA FACILITIES

ORIGINS	DESTINATIONS				
	WRHS	FAC	TT	PR	OTH
WRHS	21.2, 19.5	4.0, 3.0	2.0, 1.8	-	15.0, 21.2
FAC	7.7, 7.6	6.0, 5.7	-	-	7.5, 7.8
TT	3.0, 3.1	-	2.0, 1.6	-	-
PR	2.0, 0.8	-	-	-	-
OTH	-	-	-	-	10.0, 9.8

Source: Truck Commodity Survey, 1987 .

First number = Overall
Second number= Peak

TABLE 7
TRIP FREQUENCY RATES
FOR TRUCKS USING PA FACILITIES

FREQUENCY	%
Monthly	4.9
Weekly	11.5
More than weekly	27.4
Daily	40.2
More than daily	8.5
Other	7.4

Source: Truck Commodity Survey, 1987.

Table 8 displays the types of commodities trucks are carrying. Food accounts for the highest percentage of commodities traveling eastbound across all PA facilities, 22.5%. Apparel when traveling through the Lincoln Tunnel, is the only exception where it bypasses food by 3%.

When both directions are considered the majority of trucks, 35%, using PA facilities are empty.

TABLE 8
COMMODITY DISTRIBUTION
PA FACILITIES

OVERALL, BY FACILITY

COMMODITY	GWB	Lincoln Tunnel	Holland Tunnel	Bayonne Bridge	Goethals Bridge	Outerbr. Crossing
Farm. Food	27	14	21	15	19	23
Apparel	-	17	13	8	-	-
Paper	7	11	10	5	7	8
Mixed Freight	15	4	8	5	11	6
Furniture	6	5	5	-	6	5
Chemicals	5	5	-	6	7	-
Clay, etc.	-	-	-	-	-	7
Transp. Equip.	5	-	-	-	-	-
Other Empty	35	43	43	61	51	45

EASTBOUND, ALL FACILITIES

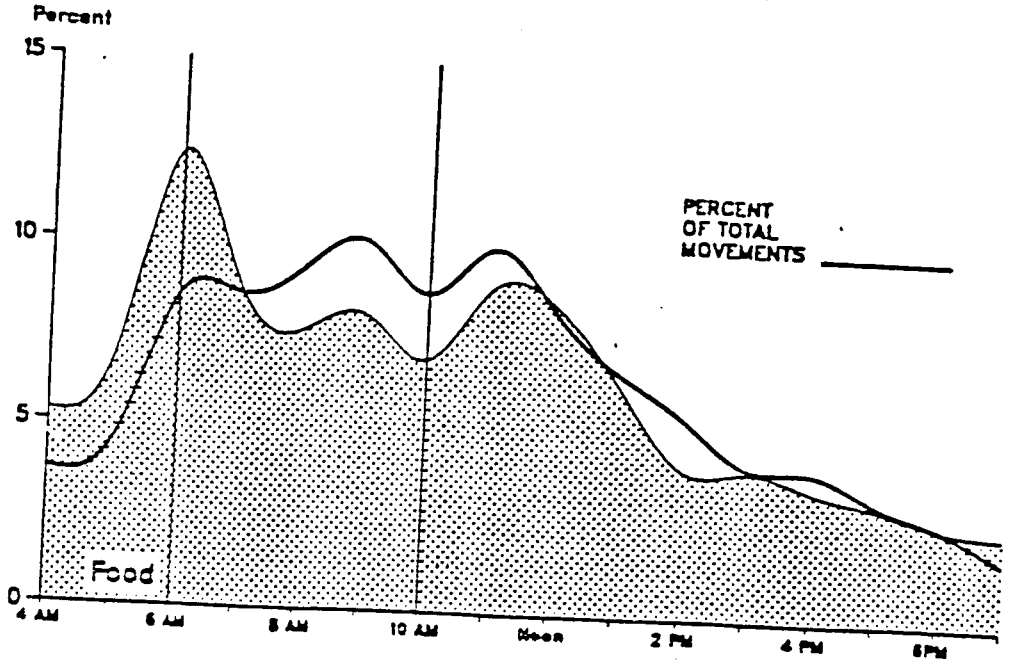
COMMODITY	PERCENT
Food/Farm Products	22.5
Mixed Freight	8.0
Paper	7.3
Furniture	4.5
Metal Products	4.0
Apparel	3.5
Chemical/Petrol	11.0
Clay/Concrete/etc.	2.5
Transportation Equip.	2.4
Electrical Mach.	2.1
Other	27.0

Source: Transportation Technical Report, 1992.

Table 9 displays selected commodities crossing the Hudson by hour. The table suggests that traffic is effected differently depending on time of the day and by delivery of certain

SELECTED COMMODITIES BY HOUR - TABLE 9

% FOOD MOVEMENTS BY HOUR



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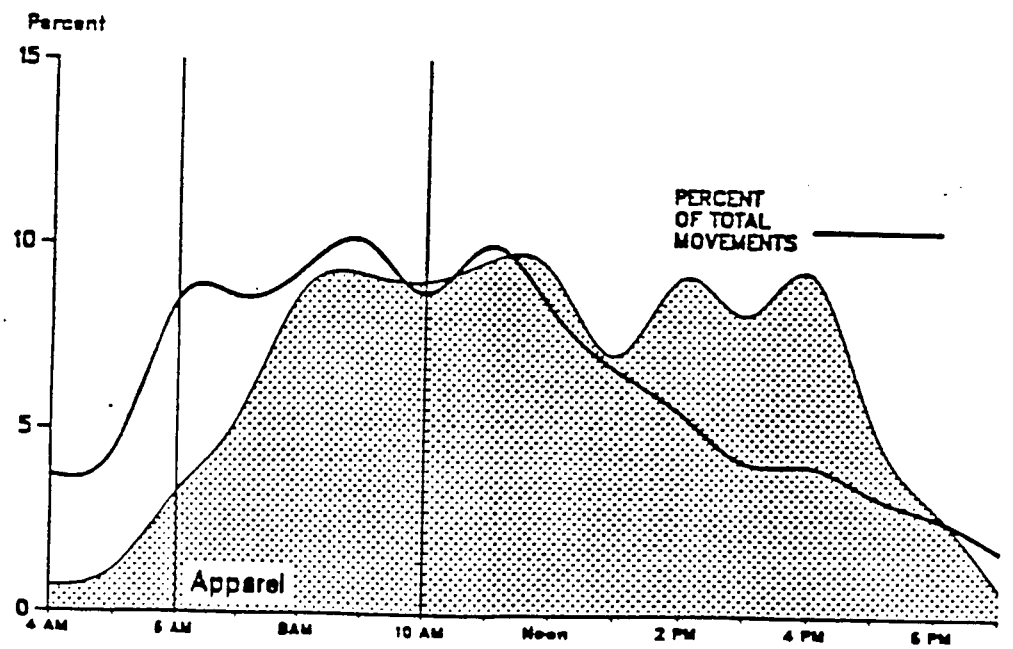
% APPAREL MOVEMENTS BY HOUR



Source: Truck Commodity Survey, 19

commodities. The majority of food is transported in the early morning, while apparel is delivered throughout most of the day.

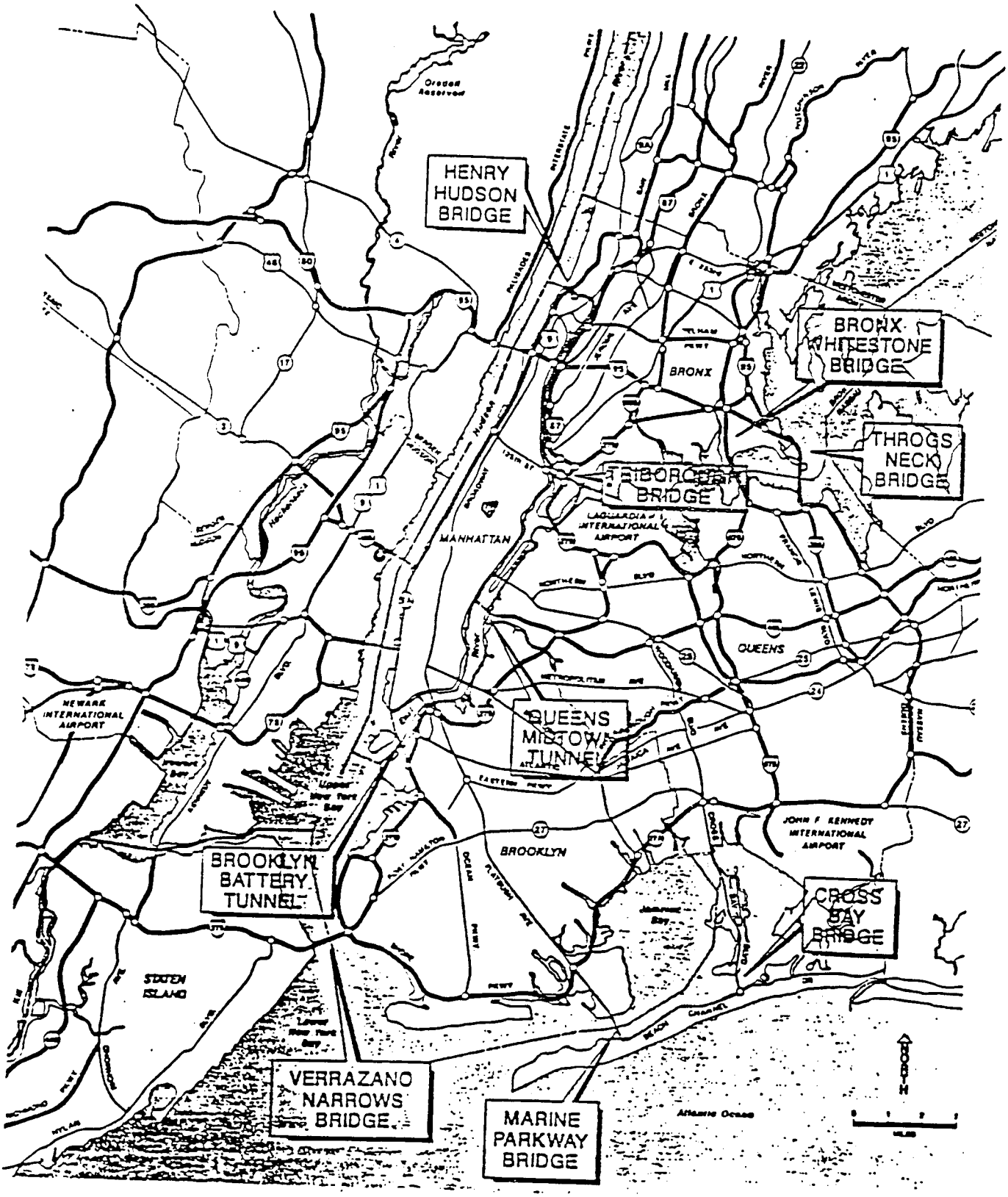
The Triborough Bridge and Tunnel Authority, responsible for tolled crossings east of the Hudson, reports that over 12 million trucks use their facilities per year representing 4.4% of total vehicles (See Map 10 and Table 10). An overwhelming majority, 52.8% have two-axles. Trucks with 5-axles come in second with 26.2%. The most widely used TBTA crossing by truck is the Triborough Bridge's Bronx Plaza 7.5% of all traffic is comprised of trucks. Most of TBTA traffic is destined for Manhattan (Detailed origin/destination survey results for PA and TBTA appear in the Appendix). A study conducted by the NYC Department of City Planning on non-tolled East River crossings including the Queensboro Bridge, the Midtown tunnel, the Williamsburg Bridge and the Manhattan Bridge, shows that 35,000 trucks move into the CBD daily. Most of these trucks also had destinations in Manhattan. Table 11 shows the yearly volumes of PA and TBTA truck crossings. Table 13 shows the tolls charged on PA and TBTA facilities for trucks.

Networks

Maps 11 through 15 plot truck networks through each borough of NYC. Map 15a shows general truck flows by particular crossing. Table 12 displays detailed destinations of trucks traveling eastbound on PA facilities during the morning peak. In sum, the GWB is mainly used by trucks to reach New England, the Bronx and Long Island. The Tunnels are primarily used to reach the CBD. The Goethals Bride is used by Staten Island and Brooklyn bound vehicles while the Outerbridge Crossing is generally used by trucks traveling north from central NJ and further south to reach Long Island via the Verrazano Narrows Bride.

MAP 10

LOCATION OF TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY'S BRIDGES & TUNNELS



Source: Optimal Toll Strategies for the TBTA, 199.

TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY CROSSINGS - 1991
Yearly Truck Traffic Volumes by Type
Percentage of Total Trucks by Type
Truck Percentage of Total Traffic

TABLE 10

FACILITIES	2-axle	3-axle	4-axle	5-axle	6-axle	7-axle	9-axle	Total Trucks	Total Traffic	% of Trucks
Triborough Bridg Bronx Plaza	1,375,738 63.61%	314,708 14.53%	100,449 4.64%	368,202 17.00%	6,670 0.31%	324 0.01%	45 0.00%	2,166,136	28,954,116	7.48%
Triborough Bridg Manhattan Plaza	313,051 75.90%	72,533 17.59%	7,147 1.73%	18,195 4.41%	1,500 0.36%	41 0.01%	0 0.00%	412,467	31,179,437	1.32%
Whitestone Bridg	970,895 49.42%	286,225 14.57%	187,733 9.56%	506,530 25.78%	12,745 0.65%	299 0.02%	33 0.00%	1,964,460	35,992,986	5.46%
Throgs Neck Brid	1,111,018 39.88%	198,472 7.12%	295,065 10.59%	1,148,554 41.23%	31,142 1.12%	1,154 0.04%	195 0.01%	2,785,600	36,841,035	7.56%
Queens Midtown	914,363 80.71%	171,746 15.16%	30,053 2.65%	15,524 1.37%	1,117 0.10%	62 0.01%	3 0.00%	1,132,868	26,175,260	4.33%
Brooklyn Battery	359,707 74.85%	97,983 20.39%	7,903 1.64%	14,151 2.94%	777 0.16%	36 0.01%	0 0.00%	480,557	20,622,049	2.33%
Verrazano Narro	1,194,128 40.49%	388,934 13.19%	240,156 8.14%	1,097,236 37.21%	27,634 0.94%	890 0.03%	122 0.00%	2,949,100	61,783,292	4.77%
Henry Hudson Br	1,676 94.96%	65 3.68%	7 0.40%	3 0.17%	0 0.00%	14 0.79%	0 0.00%	1,765	19,813,258	0.01%
Cross Bay Vetera Memorial Bridge	111,000 64.95%	44,955 26.31%	2,751 1.61%	11,452 6.70%	696 0.41%	35 0.02%	4 0.00%	170,893	5,660,868	3.02%
Marine Parkway	75,020 68.31%	22,955 20.90%	2,197 2.00%	9,205 8.38%	394 0.36%	44 0.04%	0 0.00%	109,815	8,008,899	1.37%
1991 TBTA TOT Totals (%):	6426596 52.8%	1598576 13.1%	873461 7.2%	3189052 26.2%	82675 1%	2899 0.02%	402 0.003%	12,173,661	275,031,196	4.43%

Source: Optimal Toll Strategies fot the TBTA, 1992 .

TABLE 11
VOLUMES AND PERCENTS OF YEARLY TRUCK TRAFFIC - 1991

CROSSINGS	% OF TOTAL VEHICLES	VOLUME
PA FACILITIES		
George Washington Bridge	7.5	3,595,000
Lincoln Tunnel	4.5	872,000
Holland Tunnel	5.8	878,000
Staten Island Bridges	6.3	1,726,000
TBTA FACILITIES		
Verrazano Narrows Br.	4.8	1,474,489
Whitestone Bridge	5.5	1,964,427
Throgs Neck Bridge	7.6	2,785,405
Brooklyn Battery Tu.	2.3	480,557
Queens Midtown Tunnel	4.3	1,132,865
Triborough Bridge	4.3	2,578,558

Sources: TBTA, PA.

TABLE 12
DESTINATION DISTRIBUTION NETWORK
Hudson River Crossings - Eastbound 1984-85 - Morning Peak

DESTINATION	GWB	Lincoln Tunnel	Holland Tunnel	Bayonne Bridge	Goethals Bridge	Outerbr. Crossing
Long Island	20	1	8	3	7	17
Bronx	14	2	1	-	-	-
Queens	13	9	16	6	11	19
Westchester	10	-	-	-	-	-
Manhattan	4	76	49	-	2	3
Brooklyn	3	12	24	32	39	36
Staten Island	-	-	1	43	39	22
Other	34	-	-	14	2	3
Total Volume	3,927	1,531	1,430	159	1,087	1,087

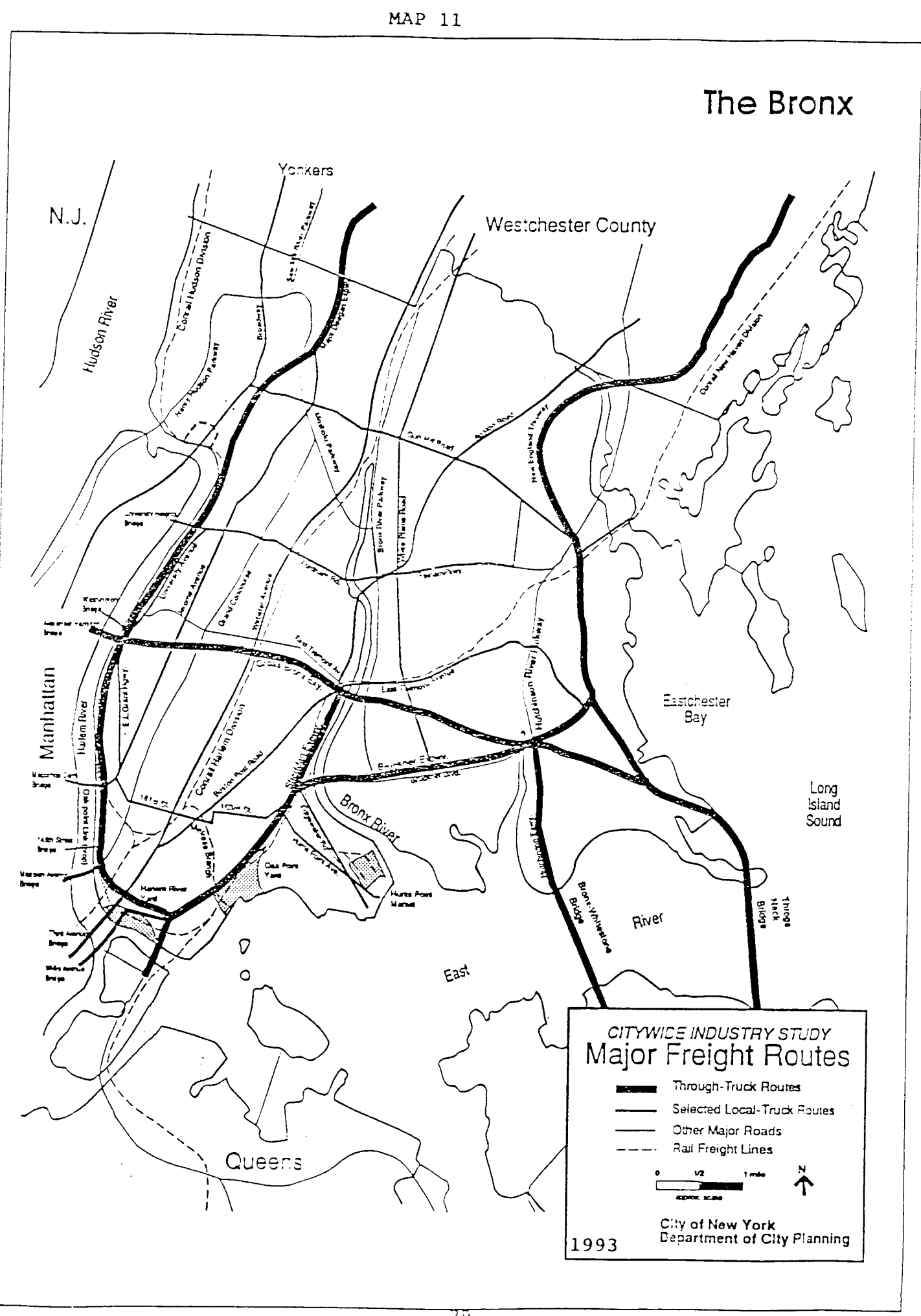
Source: Transportation Technical Report, 1992.

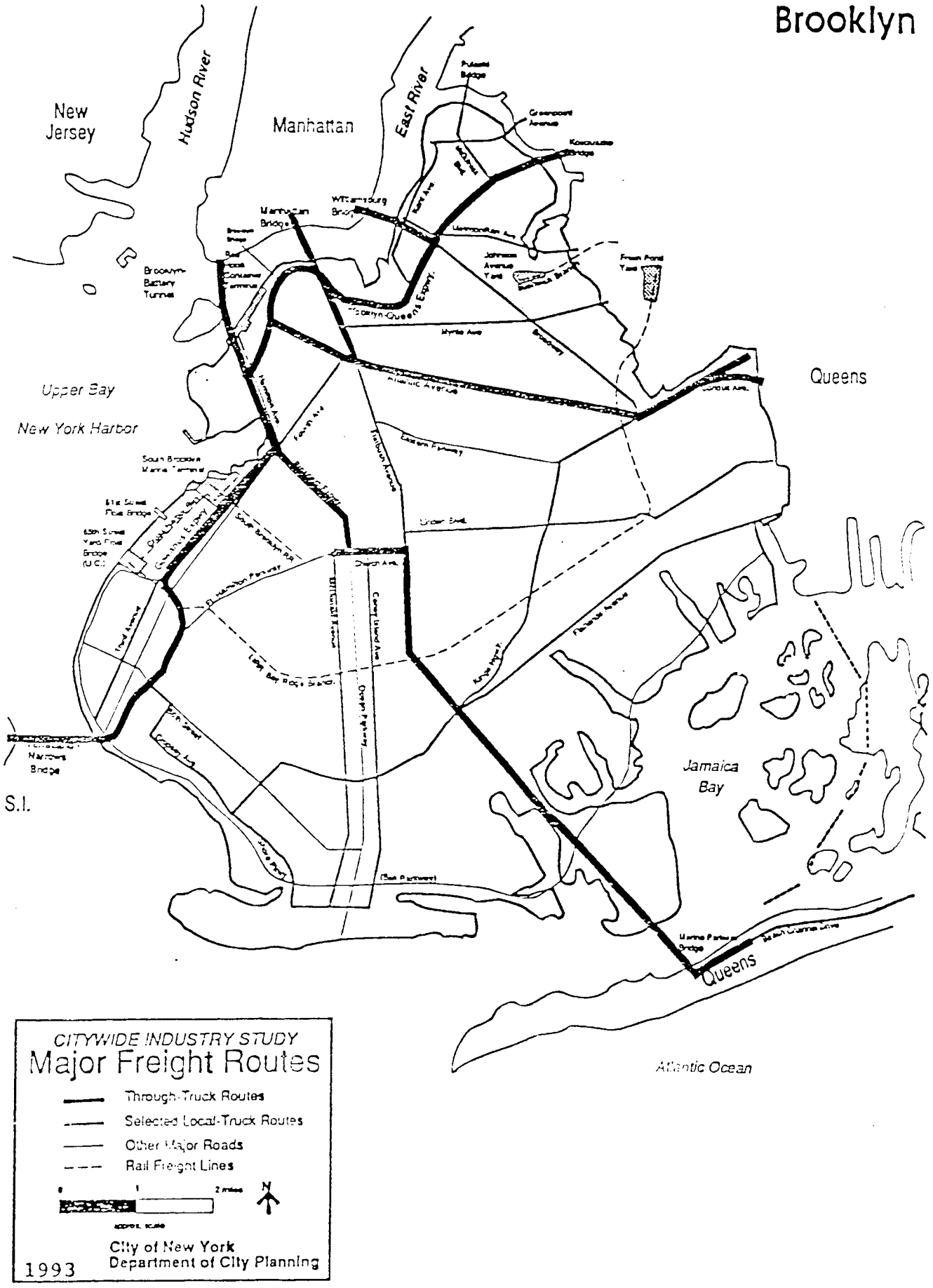
TABLE 13

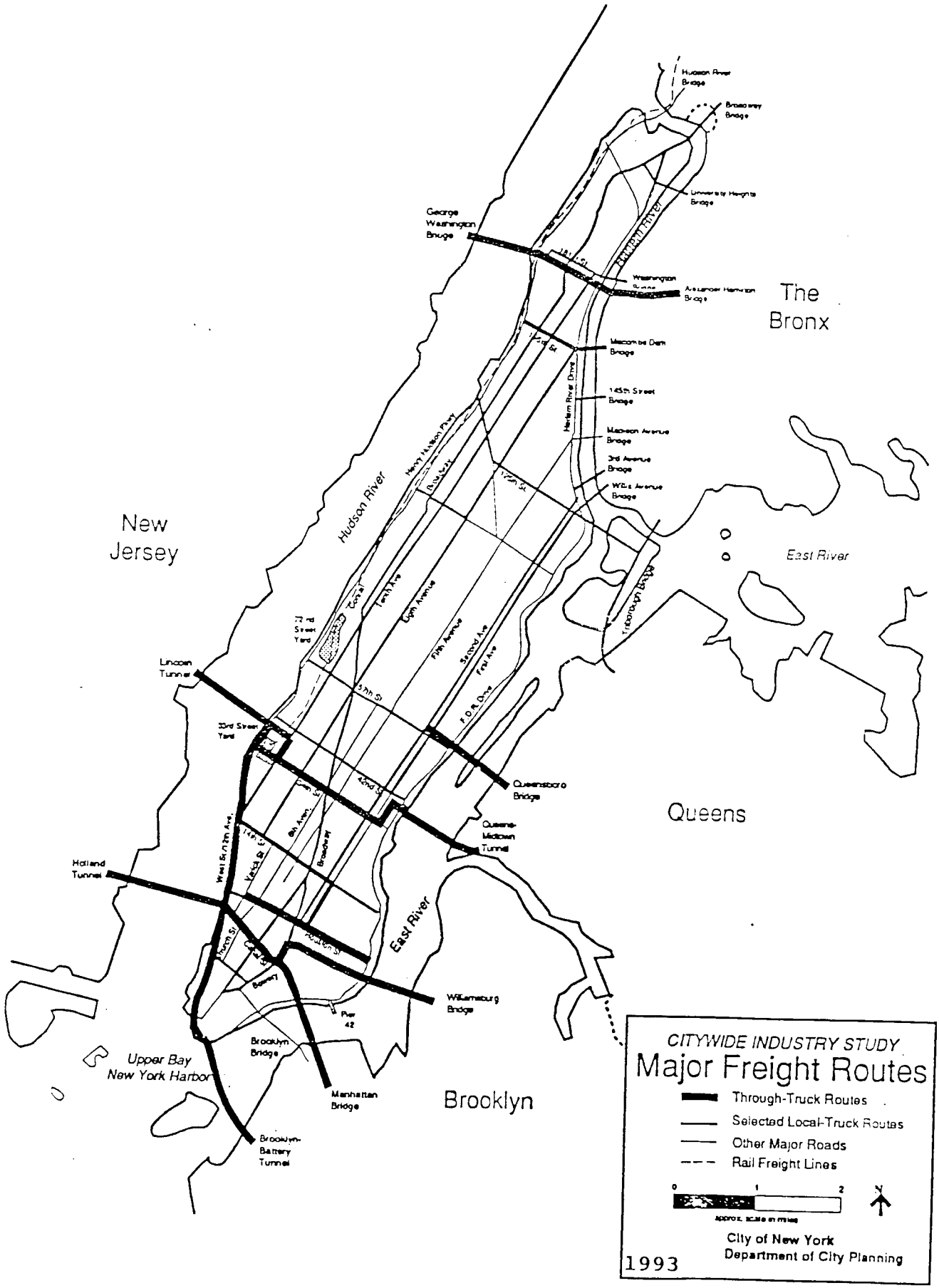
TRUCK RATES

FACILITIES	2-axle	3-axle	4-axle	5-axle	6-axle
PORT AUTHORITY OF NY & NJ (1 way collection-eastbound)					
George Washington Bridge	8.00	12.00	16.00	20.00	24.00
Lincoln Tunnel	8.00	12.00	16.00	20.00	24.00
Holland Tunnel	8.00	12.00	16.00	20.00	24.00
Bayonne Bridge	8.00	12.00	16.00	20.00	24.00
Goethals Bridge	8.00	12.00	16.00	20.00	24.00
Outerbridge Crossing	8.00	12.00	16.00	20.00	24.00
TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY (2 way collection)					
Triborough Bridge Bronx Plaza	5.00	8.00	10.00	13.00	15.00
Triborough Bridge Manhattan Plaza	5.00	8.00	10.00	13.00	15.00
Whitestone Bridge	5.00	8.00	10.00	13.00	15.00
Throgs Neck Bridge	5.00	8.00	10.00	13.00	15.00
Queens Midtown Tunnel	5.00	8.00	10.00	13.00	15.00
Brooklyn Battery Tunnel	5.00	8.00	10.00	13.00	15.00
Verrazano Narrows Bridge (1 way collection-westbound)	8.00	12.00	16.00	20.00	24.00
Henry Hudson Bridge	2.50	4.00	5.00	6.50	7.50
Cross Bay Veterans Memorial Bridge	2.50	4.00	5.00	6.50	7.50
Marine Parkway Bridge	2.50	4.00	5.00	6.50	7.50

Source: PA & TBTA.


The Bronx
N.J.
Hudson River
Yonkers
Westchester County
Manhattan
Harlem River
Bronx River
Eastchester Bay
Long Island Sound
East River
Queens
CITYWIDE INDUSTRY STUDY
Major Freight Routes
Through-Truck Routes
Selected Local-Truck Routes
Other Major Roads
Rail Freight Lines
0 1/2 1 mile
N
1993
City of New York
Department of City Planning


Brooklyn
New Jersey
Hudson River
Manhattan
East River
Queens
Upper Bay
New York Harbor
Jamaica Bay
S.I.
Atlantic Ocean
Queens
CITYWIDE INDUSTRY STUDY
Major Freight Routes
Through-Truck Routes
Selected Local-Truck Routes
Other Major Roads
Rail Freight Lines
City of New York
Department of City Planning
1993


Manhattan
The Bronx
New Jersey
Hudson River
East River
Queens
Brooklyn
Upper Bay
New York Harbor
Harlem River
Hudson River Park
Lincoln Tunnel
Holland Tunnel
Queensboro Bridge
Queens-Midtown Tunnel
Williamsburg Bridge
Brooklyn Bridge
Manhattan Bridge
Brooklyn-Battery Tunnel
Triborough Bridge
Hudson River Bridge
Broadway Bridge
University Heights Bridge
George Washington Bridge
Washington Bridge
Alexander Hamilton Bridge
Macombs Dam Bridge
145th Street Bridge
Madison Avenue Bridge
3rd Avenue Bridge
Willis Avenue Bridge
CITYWIDE INDUSTRY STUDY
Major Freight Routes
Through-Truck Routes
Selected Local-Truck Routes
Other Major Roads
Rail Freight Lines
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2
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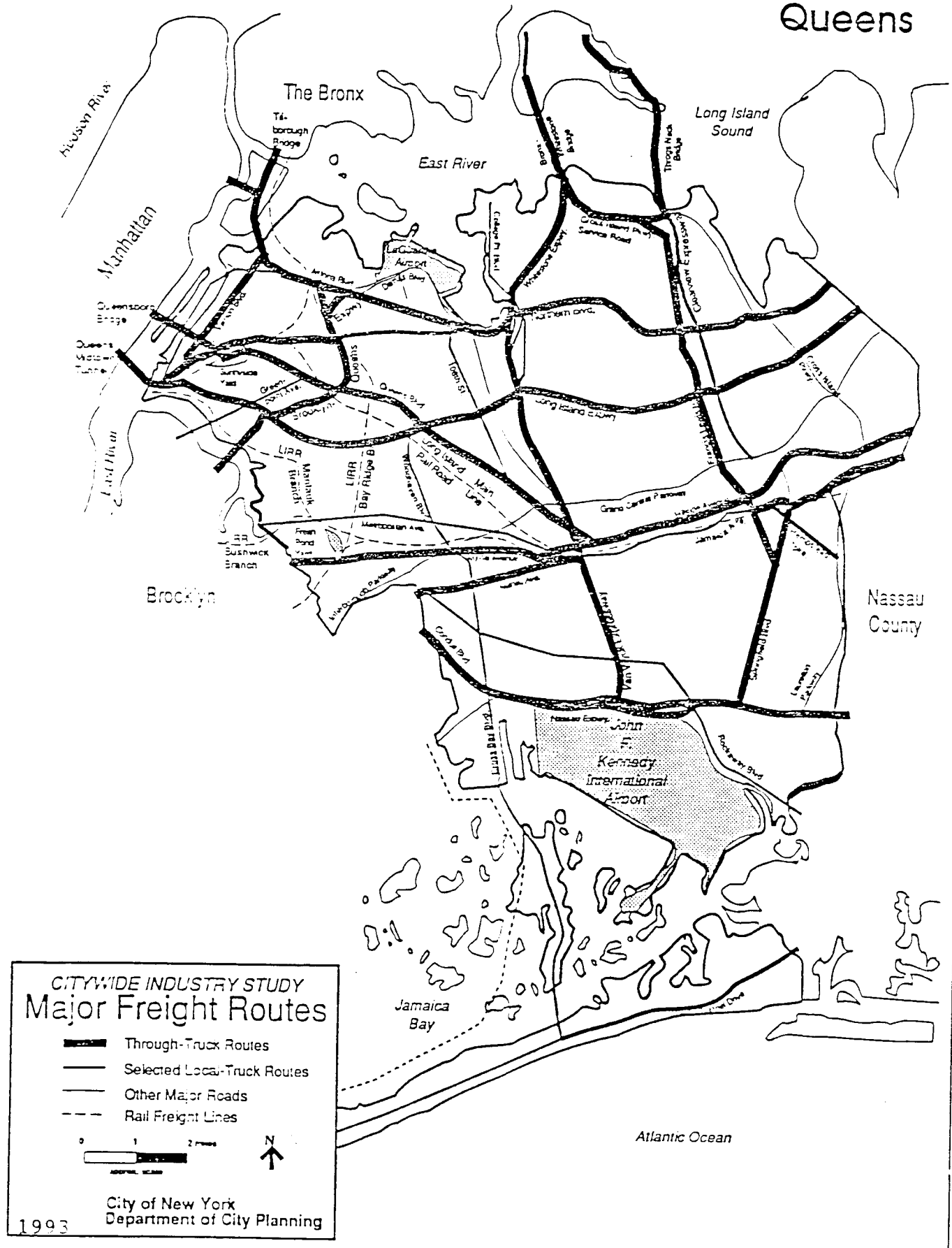
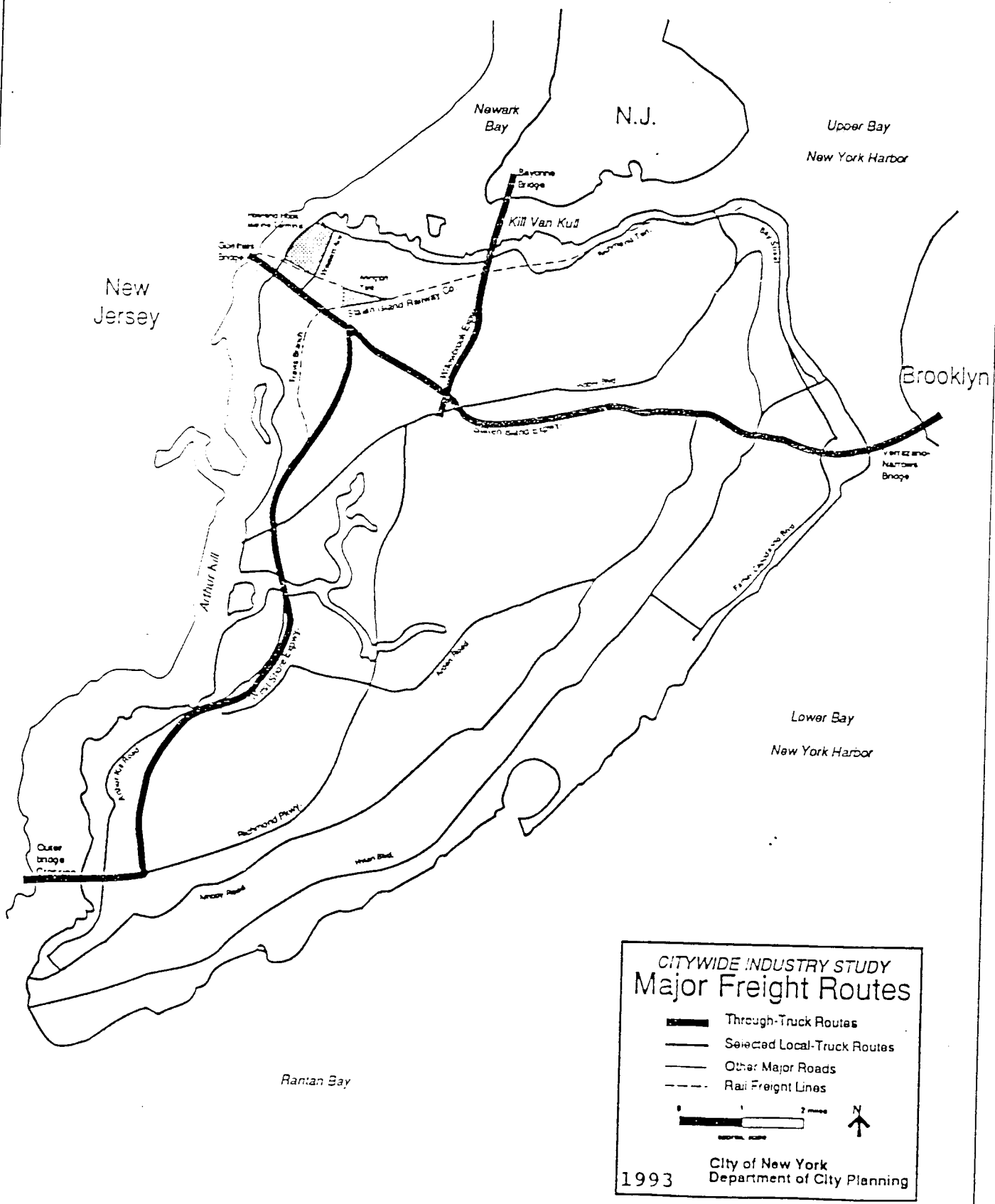
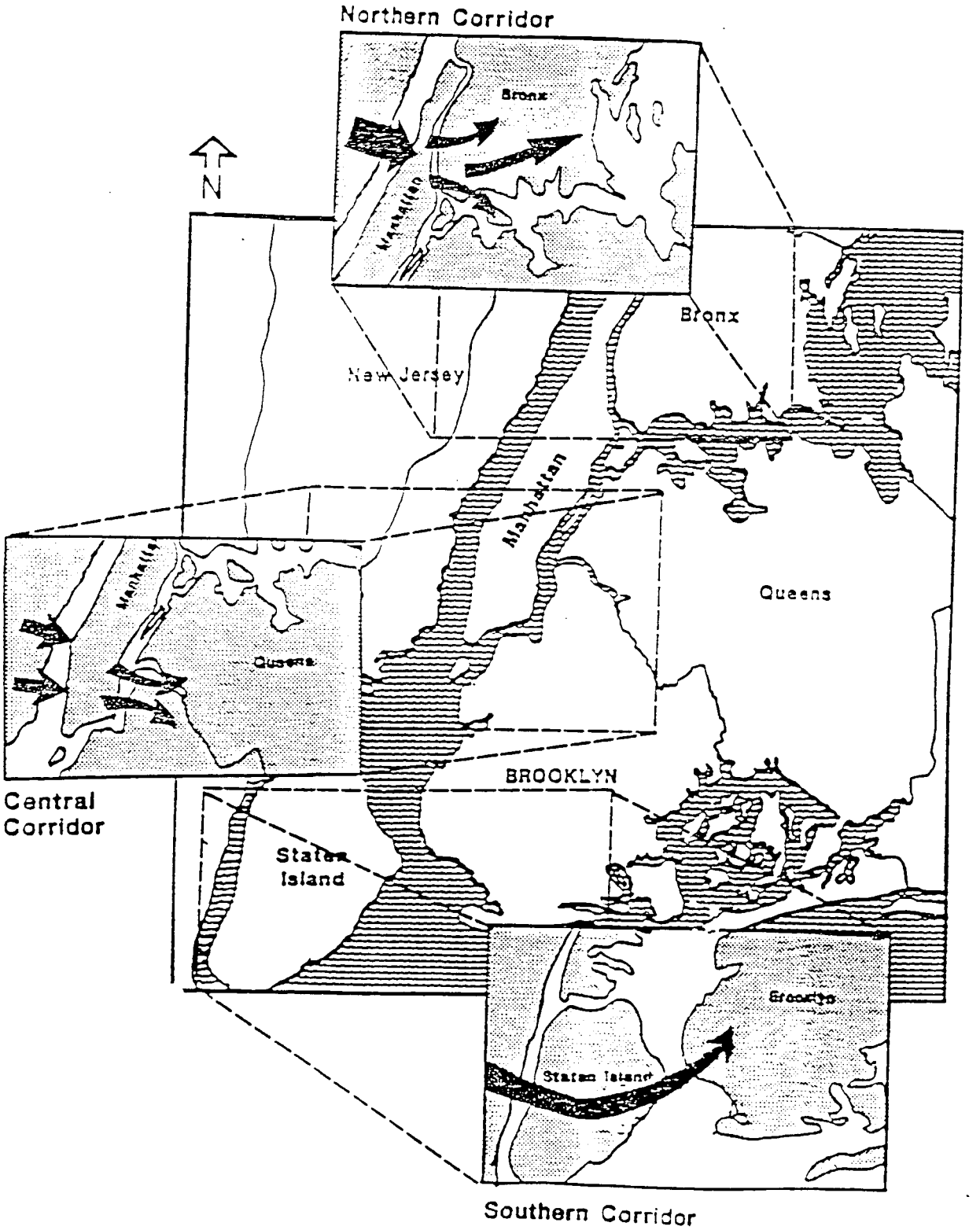
approx. scale in miles
City of New York
Department of City Planning
1993


Queens
The Bronx
Hudson River
Manhattan
East River
Long Island Sound
Brooklyn
Nassau County
Jamaica Bay
Atlantic Ocean
John F. Kennedy International Airport
LaGuardia Airport
Throgs Neck Bridge
Triborough Bridge
Queensboro Bridge
Long Island Rail Road Main Line
LIRR Bay Ridge Br
LIRR Montauk Branch
LIRR Bushwick Branch
Grand Central Parkway
Van Wyck Expressway
Belt Parkway
Cross Island Parkway
Whitestone Expwy
Clearview Expwy
Horace Harding Expwy
Jamaica Bay
CITYWIDE INDUSTRY STUDY
Major Freight Routes
Through-Truck Routes
Selected Local-Truck Routes
Other Major Roads
Rail Freight Lines
N
City of New York
Department of City Planning
1993


Staten Island
Newark Bay
N.J.
Upper Bay
New York Harbor
Bayonne Bridge
Kill Van Kull
New Jersey
Brooklyn
Arthur Kill
Lower Bay
New York Harbor
Raritan Bay
CITYWIDE INDUSTRY STUDY
Major Freight Routes
Through-Truck Routes
Selected Local-Truck Routes
Other Major Roads
Rail Freight Lines
1993
City of New York
Department of City Planning

Existing Truck Route Patterns



Many of the roadways trucks are forced to take between river crossings are severely congested. Trucks are limited by restrictions on roadways and by mission links in the networks. Examples are the prohibition of trucks and the Belt Parkway in south Brooklyn and the inability to reach the NY Thruway from I287. Lack of choices leads to volume to capacity rations (V/C) often exceeding 1.0 which is equal to Level of Service E and is categorized by stop and go traffic. Truck corridors which are severely congested include the GWB/Cross Bronx Expressway/New England Thruway and I278/Gowanus Expressway/ Brooklyn Queens Expressway/Long Island Expressway. Another severely congested roadway is the Van Wyck Expressway. This is the only truck route to John F. Kennedy International Airport (JFK) (See Map 16).

Regulations

Regional truck regulations come in many forms. Roadways, materials, delivery times, parking, width, height length and weight are all restricted and in some cases prohibited (See Map 7). As was mentioned, these regulations limit route decisions. Width and height restrictions for PA facilities are shown in Table 14. Table 15 shows regional truck weight limits. Total allowable weight is equal to the federal weight limit set in 1990 of 80,000 pounds.

Most regional infrastructure was built for trucks in use at the time, 1920s-50s. The types of trucks in wide use were chiefly comprised of a single unit less than 35 feet long. Tractor trailers were only up to 30' in length and were not in wide use. Roadway geometry, gradients and clearances were designed to fit these vehicles. Over the years, with advances in technologies, the size and weights of trucks allowed on roadways grew. Today, the largest interstate trucks are 102" wide with trailers up to 48' and 53' long. In mature urban areas, such as this Region, the damage to infrastructure, both surface and subsurface, is extensive. RPA states that one average, large, loaded truck weighing 9 tons is equal in infrastructure wear on

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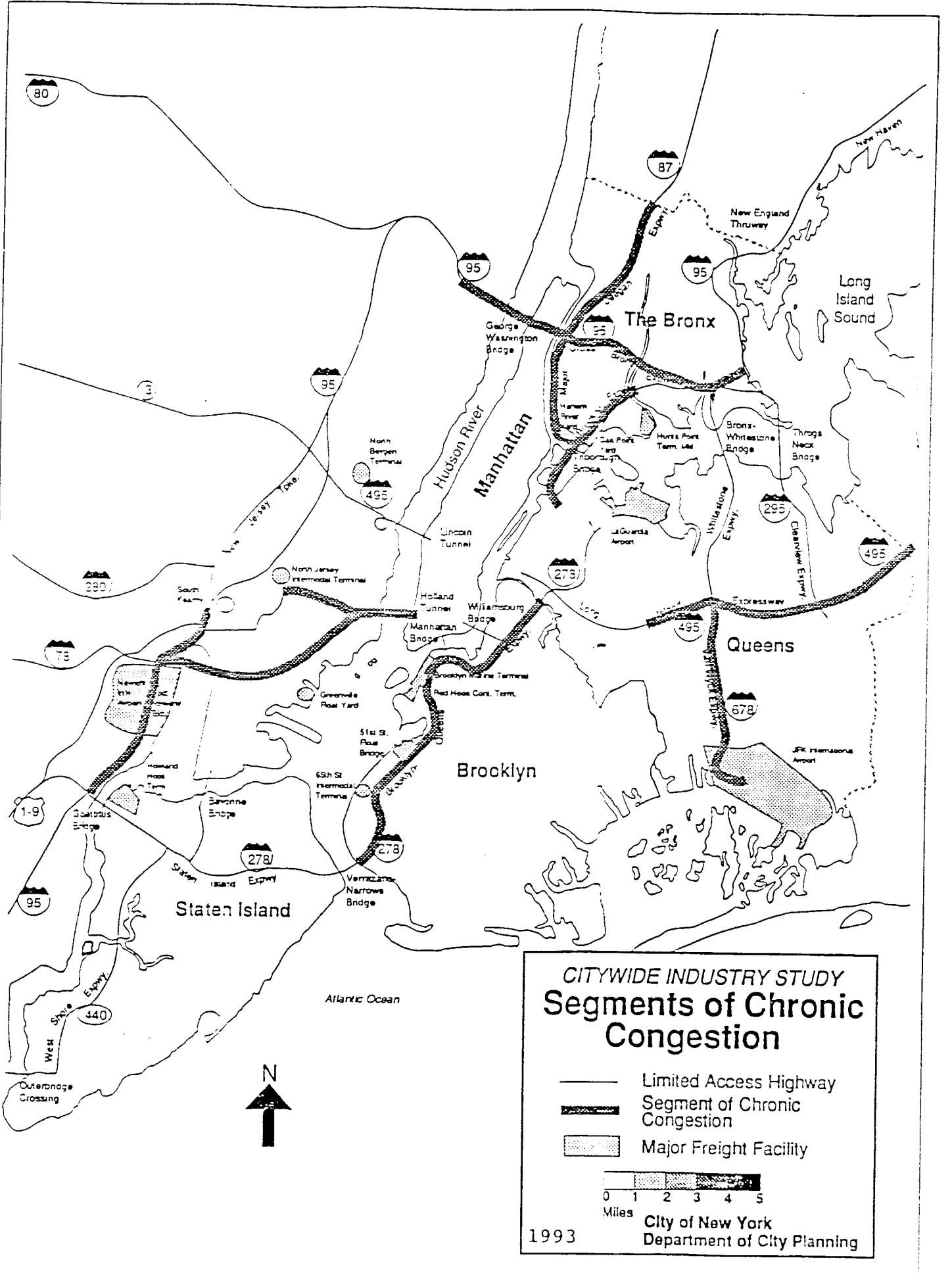

CITYWIDE INDUSTRY STUDY
Segments of Chronic Congestion
Limited Access Highway
Segment of Chronic Congestion
Major Freight Facility
0 1 2 3 4 5
Miles
1993
City of New York
Department of City Planning
The Bronx
Manhattan
Brooklyn
Queens
Staten Island
Long Island Sound
Atlantic Ocean
Hudson River
George Washington Bridge
Lincoln Tunnel
Holland Tunnel
Williamsburg Bridge
Manhattan Bridge
Brooklyn Bridge
Verrazano Narrows Bridge
Bronx-Whitestone Bridge
Throgs Neck Bridge
LaGuardia Airport
JFK International Airport
New England Thruway
Cross Bronx Expressway
Long Island Expressway
Van Wyck Expressway
Whitestone Expressway
Cross Island Parkway
Staten Island Expressway
West Shore Expressway
New Jersey Turnpike
North Bergen Terminal
North Jersey Intermodal Terminal
Greenville Road Yard
Red Hook Cont. Term.
51st St. Rail Bridge
65th St. Intermodal Terminal
Howland Hook Term.
Outerbridge Crossing
N

typical pavement to 9,600 cars. Many large trucks are prohibited from NYC roadways and cannot squeeze through many crossings, including the Holland Tunnel.

TABLE 14
PORT AUTHORITY FACILITY RESTRICTIONS

FACILITY	Width	Height	Hazardous
Holland Tunnel	8'0"	12'6"	No
Lincoln Tunnel	8'6"	13'0"	No
GWB Upper Level	8'6"	14'0"	Yes
GWB Lower Level	8'6"	13'6"	No
Sten Island Brs.	8'6"	14'0"	Yes

TABLE 15
REGIONAL TRUCK WEIGHTS, 1988

	AXLE LIMITS			MAX. GROSS WEIGHT	
STATE	Single	Tandem	Triple	Interstate	Other Roads
Connecticut	22,400	36,000	53,000	80,000	80,000
New Jersey	22,400	34,000	56,400	80,000	80,000
New York	20,000	34,000	42,500	80,000	80,000

SOURCE: Truck Weight Limits, 1990.

RAIL

While the amount of goods moved by trucks is growing, the amount moved by rail is shrinking. In fact, rail is the only mode of goods movement in the Region which has excess capacity. Between 1973 and 1989 the number of rail cars loaded with goods declined by 20% nationally, 21% in the northeast and by a monstrous 75% in the NYC Region (NYC DCP 1992). Currently, rail carries 2.8% of the Region's goods. This is opposed to the national average of 26% (RPA 1992). Still, the PA estimates that 20 million tons of freight is moved by rail per

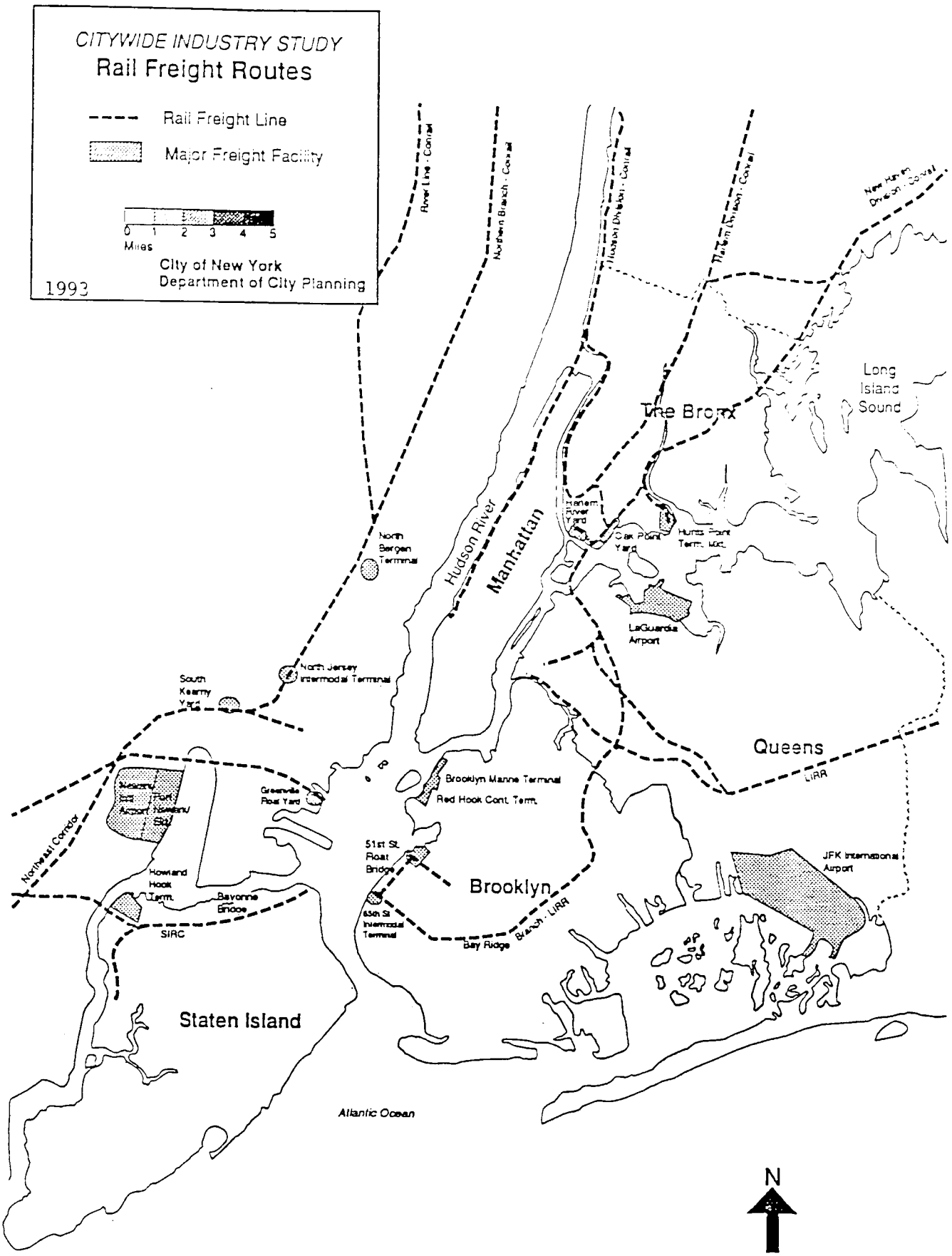
year.

Freight carried by rail is generally heavy, has low value and is not time sensitive. Building materials, paper, food and machinery are typical. Solid waste, sludge, recyclable and incinerator ash are often transported by rail.

The Region is served by a number of rail lines (See Map 17). The NY Susquehanna & Western Railroad lines carry containers to the east from the west coast. Other rail carriers in the Region include the Staten Island Railroad, the freight division of the Long Island Rail Road (LIRR), and the largest Regional freight operator, employing 87% of the Region's freight workers. Conrail, which emerged in the early 70's, links the Region with other areas of the US by their three mainline routes, the Harlem, New Haven and Hudson divisions.

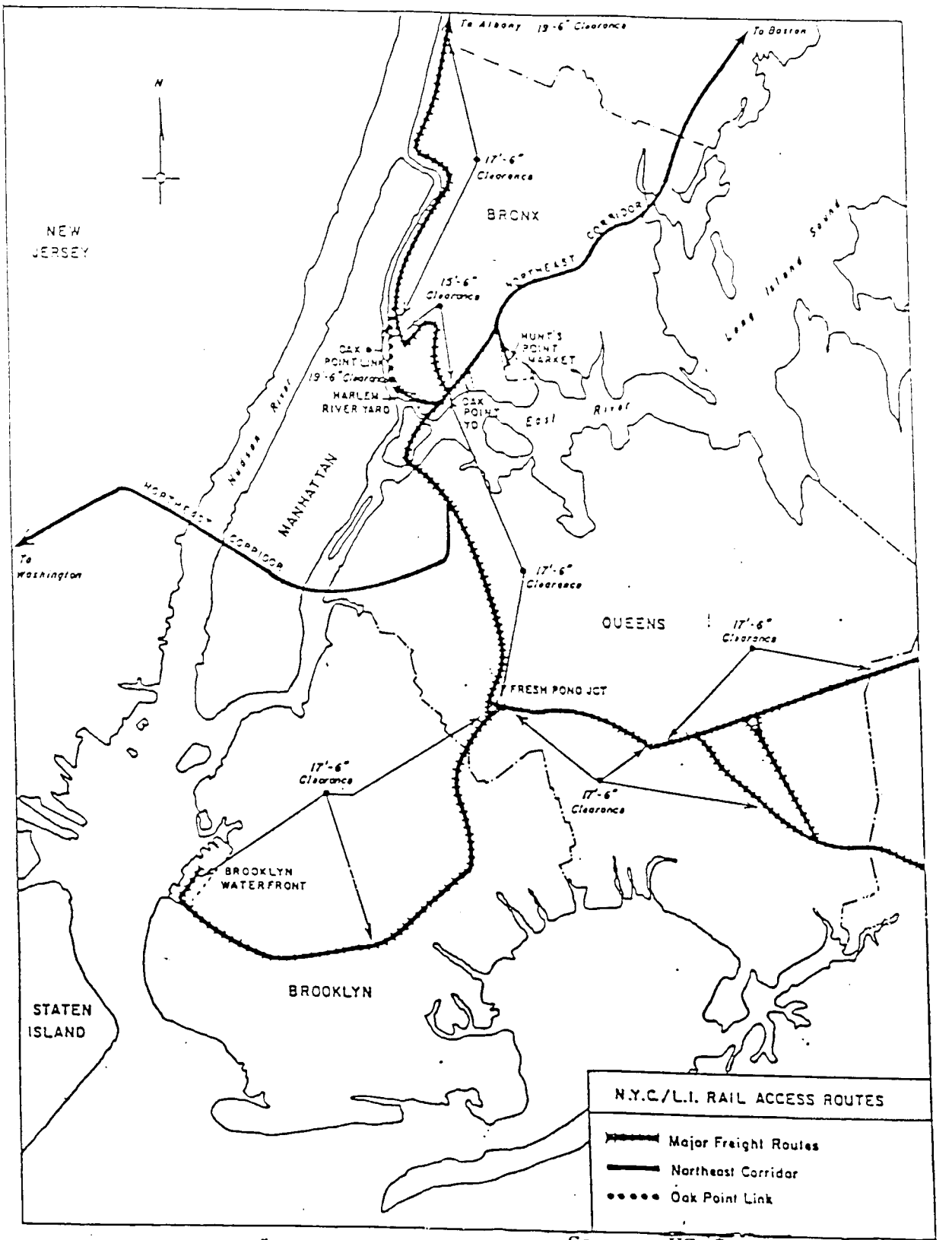
The main problems with regional rail service are the lack of space available for intermodal facilities and transfer stations, the fact that there is a large river barrier, the competition for track between rail freight and passenger service and the incompatibility of new technologies and old urban infrastructure. Clearances of some tunnels and underpasses in the Region just do not meet demands of state-of-the-art rail technologies. The widely used trailer-on-flat-car or TOFC rail services require 17'6 clearances. Double stacked cars require clearance of 20'6. Some clearances in NY are as low as 15'6" (See Map 18).

The NY Cross Harbor Railroad is a company which provides an alternative to trucking rail cargo across t he Hudson. The NYCHRR floats rail cars across the Hudson. It carries 76,000 railroad cars or the equivalent of 190,000 truck trailers (RPA 1992) from Conrail's Greenville Yard, NJ to the South Brooklyn Marine Terminal, the Bush Terminal and the 65th Street Yard,


CITYWIDE INDUSTRY STUDY
Rail Freight Routes
Rail Freight Line
Major Freight Facility
0 1 2 3 4 5
Miles
City of New York
Department of City Planning
1993
River Line - Conrail
Northern Branch - Conrail
Hudson Division - Conrail
Harlem Division - Conrail
New Haven Division - Conrail
Long Island Sound
The Bronx
Harlem River Yard
Oak Point Yard
Hunts Point Term. Mkt.
LaGuardia Airport
Hudson River
Manhattan
North Bergen Terminal
North Jersey Intermodal Terminal
South Kearny Yard
Queens
LIRR
Brooklyn Marine Terminal
Red Hook Cont. Term.
Greenville Float Yard
Newark Int'l Airport
Port Newark/Elizabeth
Northeast Corridor
51st St. Float Bridge
Howland Hook Term.
Bayonne Bridge
SIRC
65th St. Intermodal Terminal
Bay Ridge Branch - LIRR
Brooklyn
JFK International Airport
Staten Island
Atlantic Ocean
N

RAIL CLEARANCES

MAP 18



Source: US Coast Guard, 1992

Brooklyn (See Map 19). Half of the cars are then transferred to the Long Island Rail Road destined for eastern points. Others are locally delivered. A portion of the goods, which sometimes consist of rehabilitated subway cars, follows the South Brooklyn Railway operated by the NYC Transit Authority. 6,000 carfloats traveled this route in 1988 (O'Neil 1989). Each carfloat carries up to fourteen cars depending on the weight. Some trucking companies have begun to use this service and pick up cargo already in Long Island instead of from NJ. Although the cost for this service is less than moving the freight across the Hudson by truck, the total travel time is six hours or longer; more than double that of trucks. Like trucks returning to NJ, these float cars usually return empty.

Other rail lines in the Region include the LIRR which carried 1,106,000 tons or 14,000 rail cars in 1990 for a total of 122 customers (Transmode 1992) (See Map 20). The Staten Island Railroad Corporation, with lines running along the north shore of Staten Island, can serve Howland Hook but is not currently in use.

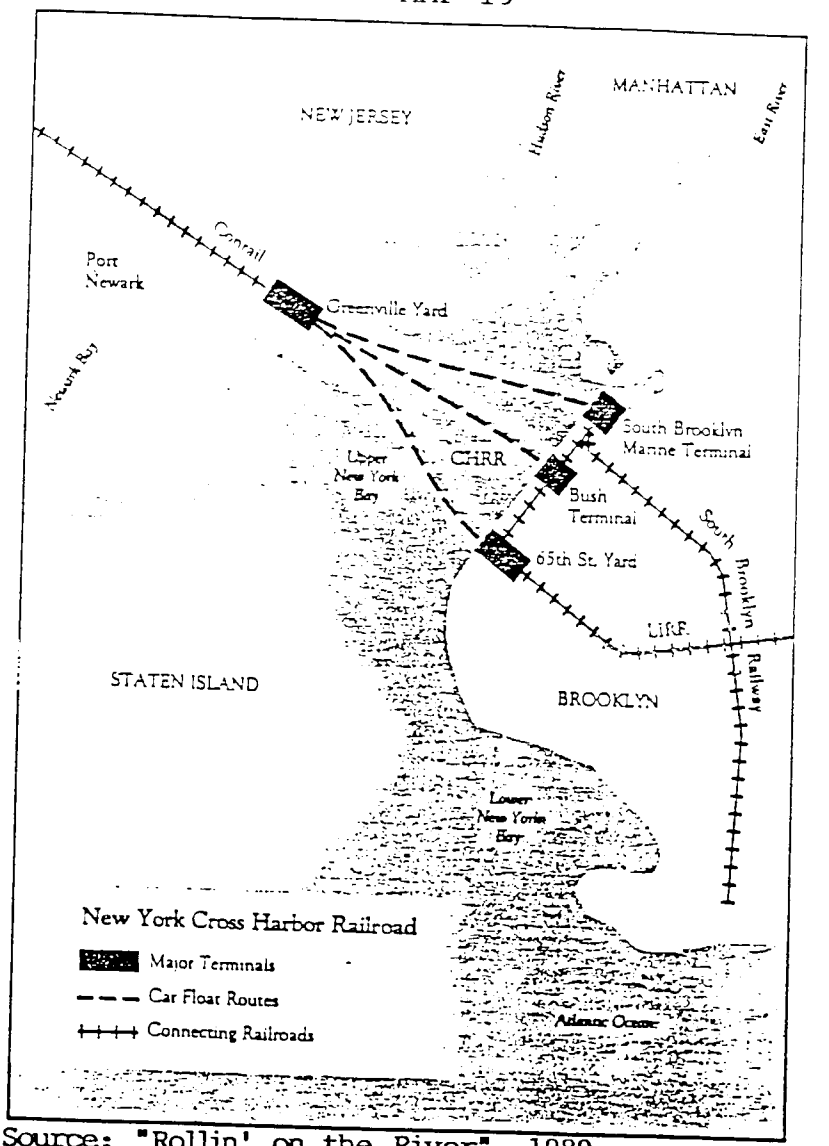
In the Bronx, the Hunts Point Market is served by rail from the north. The Harlem River Yard is an intermodal facility. To reach the Yard, trains now have to follow a zig zag route to reach. The partially constructed Oak Point Link was designed to improve access and connect the Highbridge Yard to the Harlem River Yard in the Bronx This link has been in planning stages for well over 10 years (See Map 18).

WATER

Originally, it was the productivity of its port which stimulated the Regions's growth into one of the world's major trading centers. Today this importance is dwindling. From 1986 to 1987

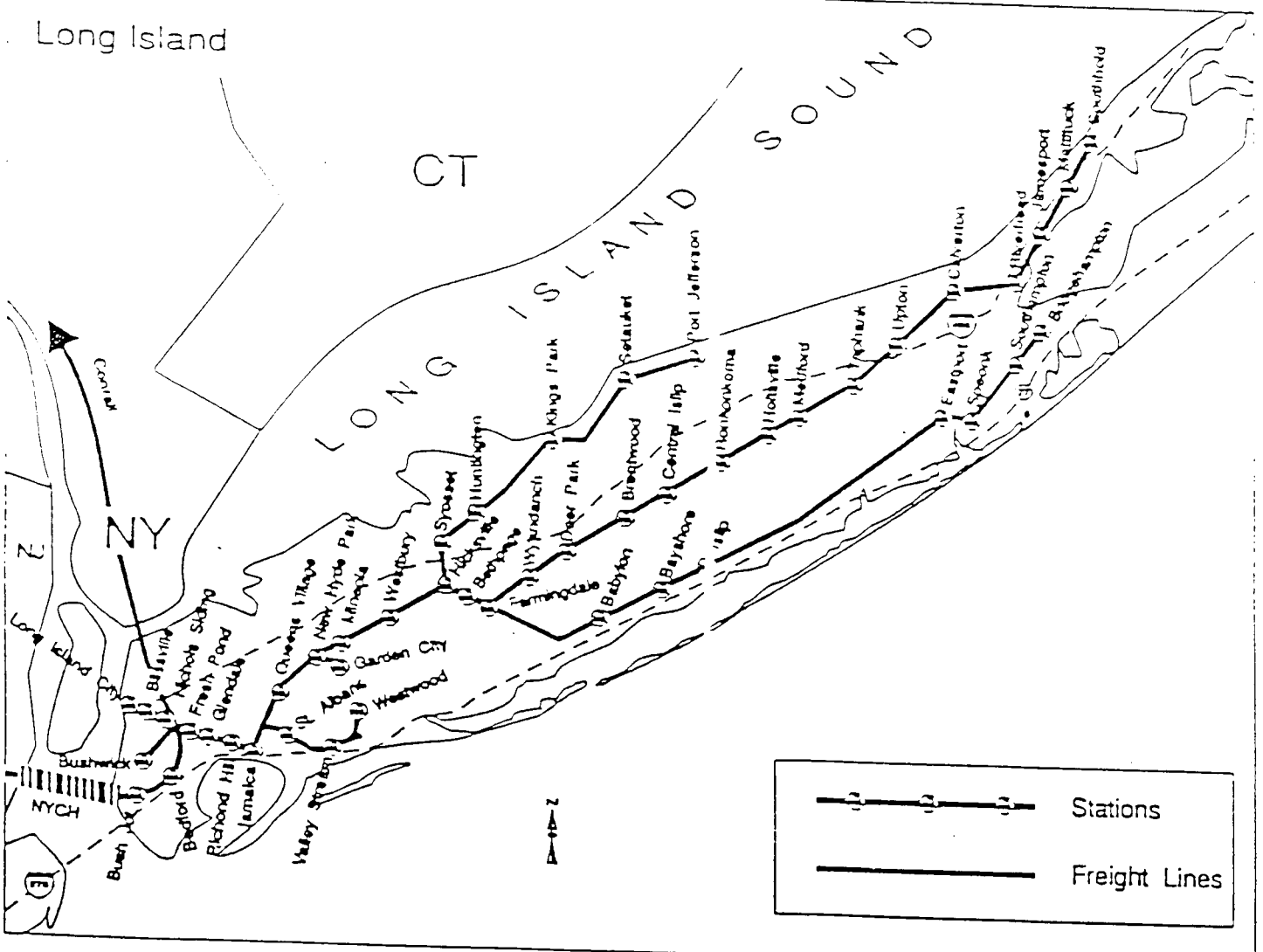
NEW YORK CROSS HARBOR RAILROAD NETWORK

MAP 19



Source: "Rollin' on the River", 1989.

LONG ISLAND RAILROAD NETWORK
MAP 20



Source: Report on Freight Strategy Study, 1992.

alone the PA reported a 5.7% decline in total waterborne cargo. Presently, this accounts for 1.7% of the Region's goods movement or about 12 million tons of goods worth $44 billion per year. This declining trend may continue with the increase in depth of channels necessary for large ships and the lack of modern warehouse space. Even more dependent on trucks than cargo delivered by rail, cargo moved by water must almost always be delivered by truck to its final destination. Except for a few chemical companies, no businesses receive shipments by water alone. As is the case with other modes, the majority of the Region's waterborne cargo now arrives in New Jersey. Before the 1960's when containerized shipping became the practice, the NY side of the Hudson handled 75% of the waterborne cargo. In 1990 it handled 15%. NY just did not have the land or infrastructure available to move and store huge containers. NJ also offered greater access to the Nation's rail and highway networks. 10% of the total truck volume in 1985 traveled across PA facilities from NJ ports (RPA 1992).

Currently, 80% of all waterborne cargo is handled by the Port Elizabeth/Newark facilities each year (See Map 6). The Red Hook Marine Terminal in Brooklyn is active and is mainly used by small and medium size shipping companies. The Howland Hook facility in Staten Island is being used for storage although in 1985 it handled 100,00 containers (DCP 1992). In Manhattan, the only commodity that is shipped by water is solid waste.

AIR

According to the PA, the total amount of goods moved by air through the Region has increased from 640 thousand tons in 1980 to nearly 2 million in 1990. The total value of these goods equaled $59 billion. In 1989 the Region's three airports - John F. Kennedy International in

Queens, Newark International in NJ and LaGuardia Airport in Queens - handled 43% of the total freight movement between the US and Europe and 35% of all freight movement between US and Asia (NJTCC/NYMTC 1989).

In contrast to goods moved by rail, goods moved by air have high value and low weight, such as electronics; are perishable or time-sensitive, such as overnight packages; or are luxury items. Although air makes up for only .25% of all regional goods movement its value per ton is high. In 1988 and 1989, the value of goods shipped by air greatly exceeded the value shipped by water. The value of cargo shipped by air equaled approximately $64,000 per ton while the value of goods shipped by water was $3,344 per ton (NYC DCP 1992).

JFK, the Region's main airport for goods movement, was responsible for 71% of the entire regional air cargo or 1.3 million tons in 1991 (See Table 16). As mentioned, the only means for trucks to reach JFK is by way of the Van Wyck Expressway. Because of its chronic congestion, the timely movement of air cargo is dependent on roadway conditions. Limited ground access also effects goods traveling to and from LaGuardia. Trucks are forced to reach LaGuardia by local streets after exiting from the BQE and Triborough Bridges. Increases in demand for guaranteed overnight delivery services and an expected 50% increase in total air cargo by the year 2000, will surely increase the strain on the Region's infrastructure. The need for nearby warehouses and sorting facilities near and at airports will also expand.

GENERAL POLICIES AND PURSUITS

The Region's system of goods movement described thus far does function to supply residents and businesses with needed goods in a relatively timely and dependent matter. However, this is not accomplished without harsh negative consequences. Lack of adequate infrastructure for

new technologies, insufficient networks, the scarcity of loading and unloading areas and limited intermodal facilities all contribute to the system's faults. High costs and severe congestion are at the top of the list.

TABLE 16
REGIONAL AIR FACILITIES

FACILITY	% of Total Cargo	Tons (in thousands)
JFK	71	1,288
Newark	26	469
LaGuardia	3	66
TOTAL		1,823

Source: Port Authority of NY & NJ, 1991

Congestion is one of the main contributor's to the Region's air quality problem. NYC is considered to have the second worst air quality in the country next to Los Angeles. A major cause of this problem is the amount of harmful emissions released in the air by vehicles. The roads are congested primarily with SOVs. But because trucks, which constitute 7% of all traffic, share the same roadways, they are forced to endure the congestion and also add to it. Idling diesel engines and double parking while loading and unloading goods contribute to the Region's air quality situation. In NYC, all diesel vehicles, including buses, contribute 3,000 tons of particulate matter (PM_{10}) per year (RPA 1992). Table 17 displays typical emissions of carbon monoxide (CO), nitrogen oxide (NO_x) and hydro carbons (HC). NYC is mandated under the Clean Air Act Amendments of 1990 to reduce levels of these harmful emissions through a State Implementation Plan. Federal law also requires trucks to comply with new standards for reductions in PM_{10} by 1994.

TABLE 17
TYPICAL TRUCK EMISSIONS AT 19MPH

VEHICLE TYPE	GRAMS/MILE		
	CO	NOx	HC
LDGV	22.7	1.2	4.0
LDGT1	27.7	1.6	4.9
LDGT2	34.8	1.9	6.5
LDGT	29.9	1.7	5.4
HDGT	85.7	5.2	12.7
LDDV	1.7	1.7	0.7
LDDT	2.0	1.9	1.0
HDDV	12.4	15.8	2.6

Source: Motor Vehicles and The Environment, 1992.
Vehicle type classification:
First two letters = heavy or light duty. (light duty < 8,500 lbs.)
Third letter = gasoline or diesel.
Fourth letter = vehicle or truck.

Another major fault in the Region's system is the exorbitant costs involved in moving goods. The system now has the highest goods movement cost in the US. The Bi-State Forum, an organization consisting of top level transportation executives in NY and NJ, has concluded that it currently costs the same amount of money to move a good from NJ to Long Island as it does to move the same size good from Pittsburgh, Pennsylvania to Long Island - a difference of 360 miles. Another calculated cost comparison deals with the delivery of small packages in the Region. Federal Express claims that it costs them 40% more to deliver in this Region than comparable other locations. United Parcel Service states that it costs them .40 cents more to deliver a package in NYC than in Atlanta, Georgia. UPS drivers make approximately 125 stops per day. This results in an addition of $50 per day per driver in NYC. The quantifiable costs of congestion and tolls greatly add to the price of goods moved throughout this Region.

The Region is committed to certain general policies to improve the goods movement system.

Increasing the flow of traffic and decreasing the dependence on trucks to move goods are examples. What is not clear is how these policies will be met. Redesigning truck routes, building new network links, limiting delivery hours, creating FOV lanes (freight only vehicles), raising clearances and other restrictions and expanding the roles of other modes by incentives or otherwise are all issues currently being planned and addressed. The question of how to maximize the productivity of the Region's goods movement system without causing infrastructure and environmental damage, prolonging travel time and/or inflating public and private costs is and will continue to be studied and debated in this Region until answers are found.

ACKNOWLEDGEMENTS

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REFERENCES

Center for Logistics and Transportation, The Graduate School and University Center of CUNY. *"Studies Toward an Integrated Transportation Plan: Improving Goods Movement in the NY Region,"* April 1992.

Darmstadter, Neill. Truck Driver Handbook, American Trucking Association, 1992.

DeLeuw, Cather & Company. *"BQE/Gowanus Expressway (I-278), Transportation Systems Management (TSM) Study,"* July, 1992.

Department of City Planning/New York City. *"East River Truck Crossing Study,"* final report, August 1991.

Department of City Planning/New York City. *"New Opportunities for A Changing Economy: Summary Report of the Citywide Industry Study,"* January 1993.

Department of City Planning/New York City. *"Waterborne Freight Transportation Study,"* May 1990.

Department of City Planning/New York City. *"Citywide Industry Study: Transportation Technical Report,"* January 1993.

International Road Federation Executive Conference. *"Motor Vehicles and the Environment,"* May 3-9, 1992.

Levy, Norman J. *"81.4 Million and 10 Years Later - The Link is Still Missing: A Report to the Legislature,"* November 1991.

Millendorf, Stuart. *"Wheels of Fortune,"* **Portfolio,** Volume 2, Number 1, Spring 1989.

New York Metropolitan Transportation Council, Freight Movement Core Working Group. *"A Strategy For Improving Freight Movement in the New York Region: A Discussion Paper,"* 1992.

New York Metropolitan Transportation Council: George Medveczky. *"Hub-Bound Travel 1990,"* September 1991.

New York Metropolitan Transportation Council. *"Long Range Plan: A Draft Summary,"* January 1992.

New York Metropolitan Transportation Council, Technical Group 1990. *"Regional Transportation Status 1989"*, December 1990.

(References Continued)

New York State Department of Transportation. *"1991 Highway Mileage Report For New York State,"* May 1992.

New York State Department of Transportation. *"BQE/Gowanus Expressway (I-278) Transportation Systems Management (TSM) Study,"* July 1992.

North Jersey Transportation Coordinating Council. *"The Regional Transportation Plan for Northern New Jersey,"* 1986.

North Jersey Transportation Coordinating Council and New York Metropolitan Transportation Council. *"Regional Transportation: Current Conditions and Future Prospects - An Interagency Assessment,"* April 1989.

New York City Department of Transportation. *"The Mobility Challenge: Transportation Issues for New York City in the 1990's."*

O'Neill, Hugh. *"Rollin' On The River: The Car Float Makes a Comeback"*, Portfolio, Volume 2, Number 1, Spring 1989.

Petretta, Danielle L. *"Patterns of Regional Development,"* unpublished thesis, Columbia University, May 1992.

Port Authority of New York and New Jersey. *"Comprehensive Annual Financial Report for the Year Ended December 31, 1991,"* 1992.

Port Authority of New York and New Jersey. *"Maximizing Regional Mobility: The New Surface Transportation Challenge,"* June 1989.

Port Authority of New York and New Jersey, Office of Business Development. *"Truck Cordon Report,"* 1987.

Port Authority of New York and New Jersey. Truckers' Guide to the Port Authority of NY & NJ Tunnels and Bridges.

Port Authority of New York and New Jersey. Traffic Rules and Regulations: for the Holland Tunnel, Lincoln Tunnel, George Washington Bridge, Bayonne Bridge, Goethals Bridge, Outerbridge Crossing, revised March 26, 1990.

Port Authority of New York and New Jersey, Freight Research Section, Freight Planning Division, Planning and Development Department. *"Truck Commodity Survey: Overall Analysis and Summary,"* October 1987.

(References Continued)

Regional Plan Association. *"The Clean Air Act,"* prepared for New York Metropolitan Transportation Council, 1992.

Regional Plan Association. *"Improving Freight Movement in Downstate New York,"* Number 2, November 1992.

Regional Plan Association. *"Working Paper Number 6: Goods Movement in the New York Region,"* March 1992.

Transmode Consultants, Inc. *"Report on The Freight Strategy Study, Freight Market Potential (Task 1)"*, prepared for Long Island Rail Road, January, 1992.

Transportation Research Board, National Research Council. "Truck Weight Limits: Issues and Options," 1990.

Transportation Executive Council. *"Goods Movement: New Jersey's Fourth Largest Industry: A Report to Governor Jim Florio,"* April 16, 1991.

United States Department of Transportation and United States Coast Guard. *"South Bronx Oak Point Link Rail Roal Improvement Re-Evaluation Statement,"* 1992.

University Transportation Research Center/Region II: Claire McKnight. *"Optimal Toll Strategies for the Triborough Bridge and Tunnel Authority,"* prepared for Triborough Bridge and Tunnel Authority, December 1992.

Wright, Paul H. amd Norman J. Ashford. Transportation Engineering: Planning and Design, 1989.

(References Continued)

INTERVIEWS

Andreski, Charles. New York State Department of Transportation.

Brady, John. Port Authority of New York and New Jersey.

Dean, Jack. Regional Plan Association.

Henry, Charles. New York Metropolitan Transportation Council.

List, George. Rensselaer Polytechnic Institute.

McDonna, Rick. New York State Department of Transportation.

Powers, John. New Jersey Department of Transportation.

Reid, Ron. New York Metropolitan Transportation Council.

Salvia, Frank. New York City Economic Development Corporation.

Simon, Mark. New York City Department of Environmental Protection.

Slavik, Steve. New York State Department of Transportation.

Turnquist, Mark. Cornell University.

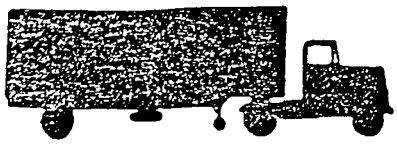
Warner, William. Regional Plan Association.

Young, Craig. New York State Department of Transportation.

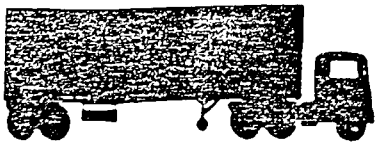
APPENDIX

TRUCK/TRAILER TYPE CONFIGURATIONS

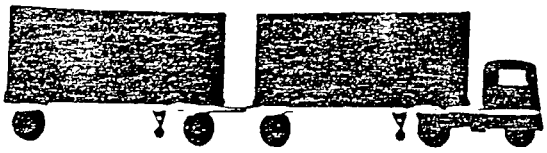
2-Axle Utility Truck
(straight)



3-Axle Utility Truck

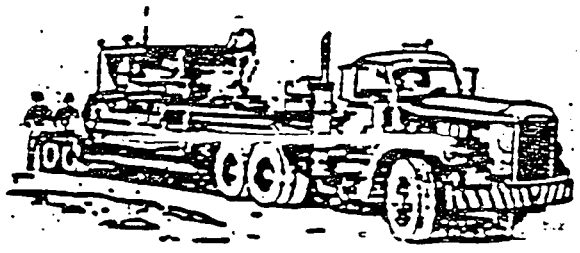


5-Axle Utility Truck

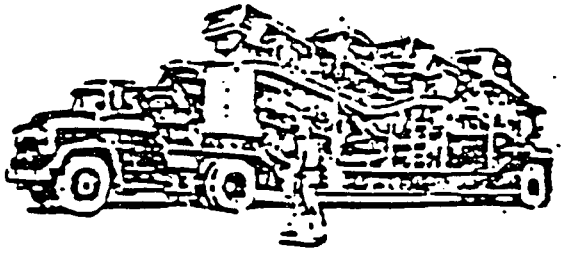


Double Trailer

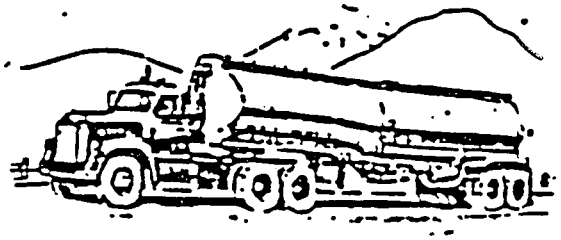
Flatbed



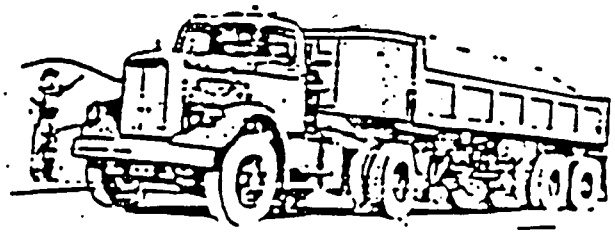
Auto Carrier



Tanker Truck



Other (Dump Truck)



Source: Port Authority of NY & NJ.

SELECTED ACRONYMS

CBD
Region's Central Business District; 60th Street and South in Manhattan

MPO
Metropolitan Planning Organization

NJ
New Jersey

NJDOT
New Jersey Department of Transportation

NJTCC
New Jersey Transportation Coordinating Council; Northern New Jersey's MPO

NYC
New York City

NYC DCP
New York City Department of City Planning

NYCDOT
New York City Department of Transportation

NYMTC
New York Metropolitan Transportation Council; Downstate New York's MPO

NYS/DOT or NYSDOT
New York State Department of Transportation

PA or PANY/NJ
The Port Authority of New York and New Jersey

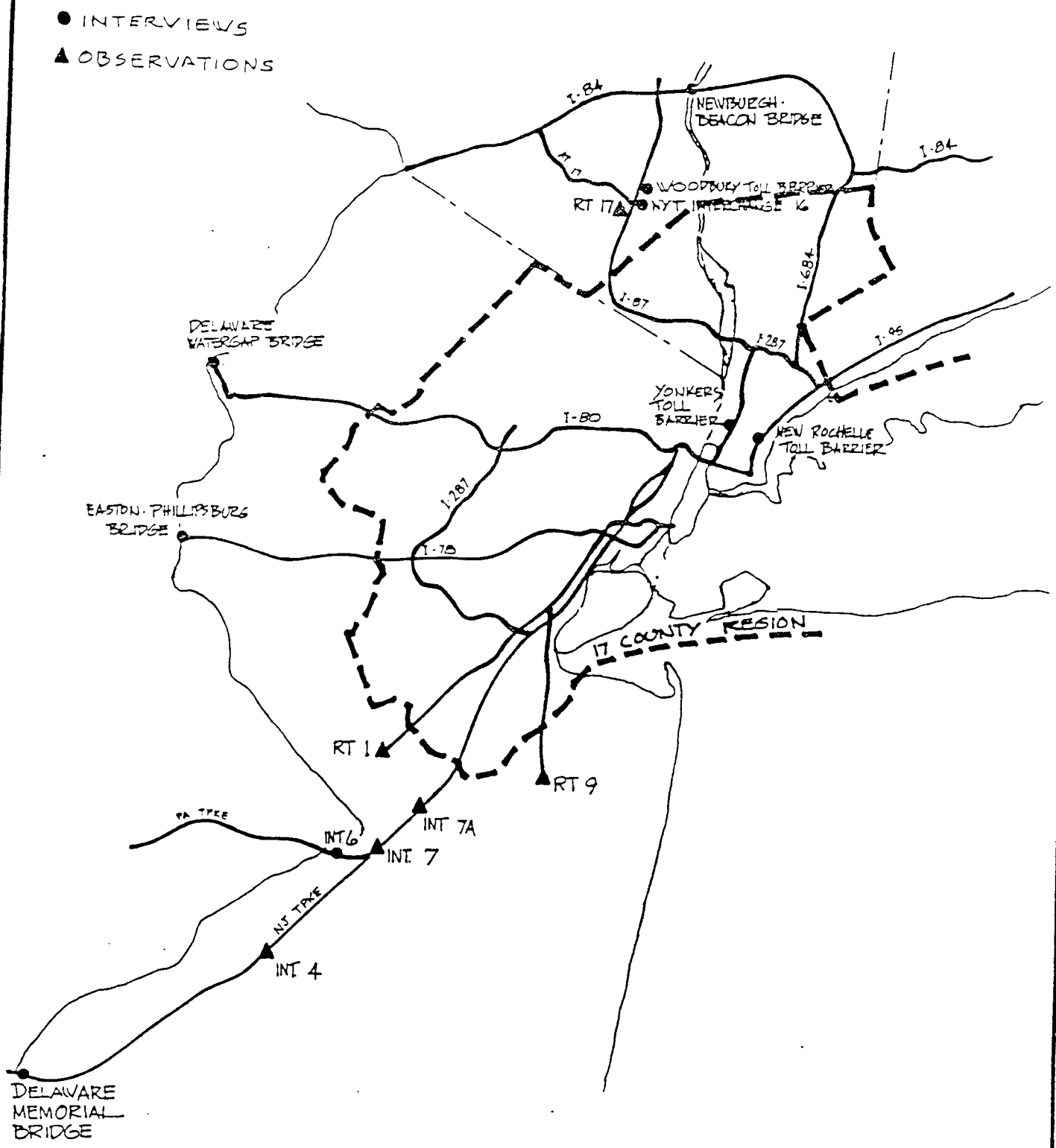
SOV
Single Occupancy Vehicle;
Passenger Vehicle with only one passenger, the driver

TBTA
Triborough Bridge and Tunnel Authority

PORT AUTHORITY DETAILED ORIGIN AND DESTINATION SURVEY RESULTS

The following tables display detailed results of origin and destination surveys conducted in 1987 by the PA. These results were calculated from interviews and observations of trucks traveling outside the PA 17 county Region. Locations are shown in Map A1. 67.2% of these trucks ended in the 17 county Region. 10% ended in the PAs outer counties (See Map 1). 22.5% were simply passing through and using the Region as a corridor. Origins and destinations of trucks traveling in specific directions are also shown. The majority of trucks traveling north originate from Baltimore, Maryland; traveling south from Connecticut; and traveling east from Pennsylvania.

1987 TRUCK CORDON SURVEY



Origins and destinations for trucks ending in the 17-county area (PA) region.

Trucks ending in region (67.2%)

Origins	%	Average Distance Miles/Kilometers	Destinations	%
Pennsylvania	30	208/335	Middlesex	15
NYS	15	276/444	Hudson	15
Connecticut	15	111/179	Union	10
Massachusetts	10	200/322	Essex	10
Maryland	5	203/327	Bergen	10
Virginia	2	205 / 330	Long Island	10
Delaware	2	205/330	Queens	5
			Brooklyn	5
Average Weighted Dist.		205 / 329		

Source: Truck Cordon Report.

Origins and destinations for trucks using the 17-county area (PA) region as corridor.

Trucks ending in the additional counties considered by PA.
Outer ring (10%)

Origins	%	Destinations	%
Connecticut	25	New Jersey	60
NYS	20	Connecticut	30
Pennsylvania	15	Orange county	10
Massachusetts	15		

Source: Truck Cordon Report.

Origins and destinations for trucks using the 17-county region as a corridor.

Trucks using region as corridor (22.5%)
Well beyond region (90%)

Origins	%	Destinations	%
Pennsylvania	20	Massachusetts	25
Connecticut	15	Connecticut	15
Massachusetts	15	Pennsylvania	15
Maryland	5	Maine	10
NYS	5	New Hampshire	10
Virginia	5	Vermont	10
North Carolina	5		

Source: Truck Cordon Report (1987) PA.

Origins and destinations for trucks traveling north.
Trucks Traveling Northbound

Origins	%	Destinations	%
Virginia	16.5	Other NJ	9.1
Delaware	13.3	Union	5.6
North Carolina	11.1	Essex	5.2
Florida	6.3	Middlesex	10.0
Georgia	4.9	Bergen	5.8
South Carolina	3.8	Hudson	6.1
Tennessee	3.8	Other NY/Canada	4.4
Kentucky	3.0	Pasc, Mors, Somset	5.8
Alabama	2.3	Connecticut	8.3
Washington DC	1.6	Rocklnd, Orange	1.0
Mississippi	1.6	Bronx	2.7
Arkansas	1.6	Other Mass.	5.1
South Jersey	0.8	Manhattan	2.0
Louisiana	0.8	Brooklyn	2.9
Baltimore	17.9	Queens	3.4
Other Maryland	10.6	Westchester	1.2
		Long Island	3.8
		Monmouth	3.6
		Boston	6.3
		Other N.E.	7.6

Source: Truck Cordon Report (1987) PA.

Origins and destinations for trucks traveling south.

Trucks Traveling Southbound

Origins	%	Destinations	%
Fairfield	12.0	Other NJ	12.0
Other CT	25.1	Union	6.7
Boston	9.3	Essex	6.7
Rochester	0.9	Middlesex	7.0
Buffalo	2.3	Bergen	7.3
Orange	9.9	Hudson	8.9
Other CAN	2.4	Other US	14.0
Montreal	2.0	DE, DC, Maryland	3.5
Vermont	1.0	Connecticut	0.8
New Hampshire	1.2	Rocklnd, Orange	2.7
Maine	2.5	Bronx	3.4
Other Mass.	12.5	Staten Island	0.4
		Manhattan	4.2
		Brooklyn	4.6
		Queens	5.2
		Westchester	6.0
		Long Island	6.3

Source: Truck Cordon Report (1987) PA.

Origins and destinations for trucks traveling east.
Trucks Traveling Eastbound

Origins	%	Destinations	%
Pennsylvania	72.5	New York City	10.1
Ohio	7.0	Union	6.9
Illinois	3.4	Essex	6.4
Indiana	2.8	Middlesex	10.0
California	3.1	Bergen	5.1
Other	11.2	Hudson	8.8
		Other NY/Canada	4.0
		Other New Eng.	9.0
		Connecticut	6.1
		Other NJ	9.7
		Passaic	3.9
		Morris	3.7
		Monmouth	2.9
		Warren	7.9
		Long Island	5.5

Source: Truck Cordon Report (1987) PA.

Origins and Destinations for TBTA Facilities

TRIBOROUGH BRIDGE BRONX PLAZA

Origin	%
Bronx	52.4
Westchester	12.3
Passaic	8.1
Bergen	6.2
Manhattan	5.3
Rockland	4.5
Queens	2.3
Fairfield	1.5
Putnam	1.1
Rest of Region	5.0
Outside Region	1.3

Destination	%
Queens	77.0
Brooklyn	12.2
Nassau	4.7
Manhattan	3.2
Rest of Region	1.3
Outside Region	1.6

TRIBOROUGH BRIDGE MANHATTAN PLAZA

Origin	%
Queens	54.7
Nassau	16.3
Bronx	9.1
Westchester	6.2
Fairfield	4.5
Brooklyn	4.3
Suffolk	1.3
Manhattan	0.9
Rest of Region	2.1
Outside Region	0.6

Destination	%
Manhattan	100.0

BRONX WHITESTONE BRIDGE

Origin	%
Bronx	48.3
Westchester	24.1
Fairfield	10.3
Passaic	2.7
Rockland	2.4
New Haven	2.2
Bergen	2.0
Manhattan	1.9
Putnam	1.5
Rest of Region	3.5
Outside Region	1.1

Destination	%
Queens	72.4
Nassau	13.9
Brooklyn	10.1
Suffolk	1.1
Manhattan	0.4
Rest of Region	0.8
Outside Region	1.3

Source: Optimal Toll Strategies for the TBTA, 1992.

Continued

THROGS NECK BRIDGE

Origin	%
Bronx	40.1
Westchester	16.0
Passaic	9.7
Bergen	7.0
Fairfield	6.2
Manhattan	5.9
Rockland	3.4
New Haven	1.4
Putnam	1.3
Hudson	1.0
Rest of Region	5.4
Outside Region	2.6

Destination	%
Nassau	50.7
Queens	42.8
Suffolk	4.1
Manhattan	0.1
Rest of Region	1.7
Outside Region	0.6

QUEENS MIDTOWN TUNNEL

Origin	%
Queens	54.2
Nassau	32.8
Brooklyn	2.8
Suffolk	2.7
Manhattan	1.1
Rest of Region	2.8
Outside Region	3.6

Destination	%
Manhattan	100.0

BROOKLYN BATTERY TUNNEL

Origin	%
Brooklyn	65.3
Staten Island	19.8
Queens	4.1
Nassau	3.0
Manhattan	1.0
Rest of Region	3.6
Outside Region	3.2

Destination	%
Manhattan	100.0

Source: Optimal Toll Strategies for the TBTA, 1992.

Continued

VERRAZANO NARROWS BRIDGE

Origin	%	Destination	%
Brooklyn	63.6	Staten Island	66.2
Queens	14.4	Hunterdon	7.7
Nassau	8.3	Passaic	7.0
Manhattan	7.9	Monmouth	5.2
Staten Island	1.1	Hudson	3.6
		Manhattan	0.2
Rest of Region	2.0	Rest of Region	6.5
Outside Region	2.7	Outside Region	3.6

HENRY HUDSON BRIDGE

Origin	%	Destination	%
Bronx	49.0	Manhattan	100.0
Westchester	34.0		
Fairfield	8.2		
New Haven	1.1		
Putnam	1.0		
Manhattan	0.9		
Rest of Region	3.5		
Outside Region	2.3		

Source: Optimal Toll Strategies for the TBTA, 1992.

ADDENDUM

ADDENDUM

This addendum was prepared in response to specific questions of the Public Planning & Policy Studies, Inc. Additional sources noted where appropriate.

MOTOR VEHICLES

1991 NYC ANNUAL MOTOR VEHICLE REGISTRATION						
Passenger	Rental Car	Commercial	Bus	Taxi	Motorcycle	TOTAL
1,823,958	23,072	92,482	6,191	43,134	18,827	2,007,664
SOURCE: Regional Transportation Status 1991, NYMTC						

1991 - US RETAIL SALES OF TRUCKS BY GROSS VEHICLE WEIGHT RATING IN POUNDS								
Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Total
6,000 & Less	6,001-10,000	10,001-14,000	14,001-16,000	16,001-19,500	19,501-26,000	26,001-33,000	33,001 & Over	All Trucks
3,246,275	876,257	21,256	23,829	3,301	22,445	72,598	98,711	4,364,672
SOURCE: American Trucking Association Information Center.								

According to the NYS Department of Motor Vehicles, in New York City there were 92,482 registered commercial trucks in 1991. In NY State there were 1,156,257 registered commercial trucks in 1991.

COMMODITIES

1991 US RAIL TONS ORIGINATED, REVENUE and CARLOADS BY COMMODITY					
	TONS ORIGINATED		REVENUE		
COMMODITY	Tons (000)	% of Total	$ in millions	% of Total	CARLOADS*
Coal	560,036	40.5	6,903	23.5	5,683
Farm Products	144,432	10.4	2,332	8.0	1,605
Chemicals & Allied Products	127,428	9.2	4,070	13.9	1,576
Non-metallic Minerals	99,253	7.2	824	2.8	1,075
Food & Kindred Products	83,149	6.0	2,253	7.7	1,316
Lumber & Wood Products	48,488	3.5	1,281	4.4	716
Metallic Ores	45,482	3.3	400	1.4	499
Stone, Clay & Glass Products	39,259	2.8	878	3.0	479
Primary metal Products	37,855	2.7	1,025	3.5	503
Petroleum Products	36,395	2.6	861	2.9	513
Pulp, Paper & Allied Products	33,030	2.4	1,502	5.1	616
Waste & Scrap Materials	27,451	2.0	515	1.8	433
Transportation Equipment	20,640	1.5	2,555	8.7	1,004
Forwarder and shipper association traffic					117
All other	79,806	6.8	3,920	13.4	4,733
TOTAL	1,302,711	100.0	29,319	100.0	20,868
SOURCE: Railroad Facts, Association of American Railroads, 1992.					

* One carload is equal to one rail car. There is no standard unit of measure for rail cars. They

differ in size and shape depending on many factors including the commodity being carried. There are maximums for cubic feet and pounds for rail car types listed in a large document entitled Official Railway Equipment Register.

1989 - US PRINCIPAL COMMODITIES IN WATERBORNE COMMERCE						
	DOMESTIC		FOREIGN		TOTAL	
COMMODITIES	TONS in millions	PERCENT	TONS in millions	PERCENT	TONS in millions	PERCENT
Chemicals	67.8	6.1	68.8	6.6	136.6	6.4
Coal & Coke	210.8	19.1	121.6	11.7	322.5	15.5
Grains	57.1	5.2	113.2	10.9	170.1	8.0
Iron Ore, iron & Steel	69.7	6.3	56.1	5.4	125.8	5.9
Logs & Lumber	21.2	1.9	36.1	3.5	57.3	2.7
Petroleum & Products	463.5	42.1	431.5	41.6	895.1	41.8
Sand, Gravel & Stone	90.4	8.2	10.7	1.0	101.1	4.7
All Other	122.0	11.1	199.9	19.3	321.9	15.0
TOTAL TONNAGE	1102.5	100.0	1037.9	100.0	2140.4	100.0
SOURCE: Waterborne Commerce of the United States - 1989, Department of The Army Corps of Engineers.						

NOTE: Domestic commerce includes all commercial movements within and between the US, Puerto Rico and the Virgin Islands. Foreign commerce includes all commercial movements between the US, Puerto Rico, the Virgin Islands and foreign ports.

CENTERLINE HIGHWAY MILEAGE BY JURISDICTION NEW YORK CITY				
COUNTY	Locally Owned	NYS DOT Owned	Other State Owned	Total State & Local
Bronx	743.46	38.11	8.05	789.62
Brooklyn	1477.73	18.66	5.04	1501.43
Manhattan	560.80	10.65	33.22	604.67
Queens	2364.67	48.48	9.15	2422.30
Staten Island	730.08	21.75	7.46	759.29
TOTAL	5876.74	137.65	62.92	6077.31
SOURCE: 1991 Highway Mileage Report, NYS DOT.				

1990 - PERCENT OF FUNCTIONALLY CLASSIFIED ROADS IN NYC AS COMPARED TO FEDERAL GUIDELINES		
CLASSIFICATION	% of all roads in NYC by classification	Federal classification guidelines by percent
ARTERIAL	22.72	15-20
Principal Arterial	12.90	5-10
Interstate	1.52	
Other	11.38	
Minor Arterials	9.82	
COLLECTOR	14.93	5-10
LOCAL	62.35	65-80
SOURCE: New York State Department of Transportation.		

In New York State, there are a total of 111,440 miles of roadway. 50.6% are town-owned, 18.3% are county-owned, 14.7% are state-owned, 10.8% are city-owned and 5.6% are village-owned (NYS DOT). There are 34,268 centerline miles of roadway in NJ (NJ DOT).

1990 NYC URBAN CENTERLINE MILEAGE BYCLASSIFICATION															
	ARTERIALS														
			Principal Arterials												
	ALL ARTERIALS		Total Principal		Interstate		Other		Minor Arterials		COLLECTOR		LOCAL		TOTAL MILES
AREA	Miles	% of area total	Miles	% of area total	Miles	% of area total	Miles	% of area total	Miles	% of area total	Miles	% of area total	Miles	% of area total	Miles
Bronx	169.20	21.44	148.68	18.84	30.65	3.88	118.03	14.95	20.52	2.60	163.42	20.70	456.70	57.86	789.32
Brooklyn	425.96	28.36	213.72	14.23	13.20	.88	200.52	13.35	212.24	14.13	142.40	9.48	933.70	62.16	1502.06
Manhattan	259.16	42.87	133.63	22.10	5.93	.98	127.70	21.12	125.53	20.76	148.36	24.54	197.04	32.59	604.56
Queens	457.20	18.87	243.12	10.03	33.48	1.38	209.64	8.65	214.08	8.84	259.82	10.72	1705.86	70.41	2422.88
Staten Island	69.08	9.11	44.58	5.88	8.97	1.18	35.61	4.69	24.50	3.23	193.50	25.50	496.11	65.39	758.69
NYC TOTAL	1380.60	22.72	783.73	12.90	92.23	1.52	691.50	11.38	596.87	9.82	907.50	14.93	3789.41	62.35	6077.51
SOURCE: New York State Department of Transportation.															

A rough and possibly out-of-date estimate for the percentage of paved roads & parking lots offered by NYS DOT is approximately 17% of NYC's total square miles.